JOINT SERVICES PUBLICATION: 912

HUMAN FACTORS INTEGRATION FOR DEFENCE SYSTEMS

Version 2i (internet)
25th June 2013

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Produced and maintained by: the Engineering Group (EG), DE&S.

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### Amendment Record Sheet

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<th>Description</th>
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<tbody>
<tr>
<td>AOF</td>
<td>Acquisition Operating Framework</td>
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<tr>
<td>BoK</td>
<td>Body of Knowledge</td>
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<td>BS</td>
<td>British Standard</td>
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<tr>
<td>CADMID</td>
<td>Concept, Assessment, Demonstration, Manufacture, In-service, Disposal</td>
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<tr>
<td>CE</td>
<td>Consensus based on Evidence</td>
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<tr>
<td>COEIA</td>
<td>Combined Operational Effectiveness and Investment Appraisal</td>
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<tr>
<td>CONEMP</td>
<td>Concept of Employment</td>
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<tr>
<td>CONOPS</td>
<td>Concept of Operations</td>
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<tr>
<td>COTS</td>
<td>Commercial Off-The-Shelf</td>
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<tr>
<td>CSA</td>
<td>Customer-Supplier Agreement</td>
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<td>DASB</td>
<td>Defence Aviation Safety Board</td>
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<td>DE&amp;S</td>
<td>Defence Equipment and Support</td>
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<td>Def Stan</td>
<td>Defence Standard</td>
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<tr>
<td>DLOD</td>
<td>Defence Line of Development(s)</td>
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<td>Dstl</td>
<td>Defence Science and Technology Laboratory</td>
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<td>DTech</td>
<td>Director Technology</td>
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<td>DTC</td>
<td>Defence Technology Centre</td>
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<td>EG</td>
<td>Engineering Group</td>
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<td>EHFA</td>
<td>Early Human Factors Analysis</td>
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<td>EN</td>
<td>Euro Norm</td>
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<td>HAZAN</td>
<td>Hazard Analysis</td>
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<td>HAZID</td>
<td>Hazard Identification</td>
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<td>HCI</td>
<td>Human Computer Interaction</td>
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<td>HF</td>
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<td>Human Factors Integration</td>
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<td>HFICR</td>
<td>Human Factors Integration Considerations Register</td>
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<td>Human Factors Integration Focus</td>
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<td>HFIG</td>
<td>Human Factors Integration Group</td>
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<td>HFIP</td>
<td>Human Factors Integration Plan</td>
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<td>HFIWG</td>
<td>Human Factors Integration Working Group</td>
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<tr>
<td>HMI</td>
<td>Human Machine Interface</td>
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<td>HSG</td>
<td>Human Systems Group</td>
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<td>HV</td>
<td>Human View</td>
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<tr>
<td>IEHIF</td>
<td>Institute of Ergonomics and Human Factors</td>
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<tr>
<td>INM</td>
<td>Institute of Naval Medicine</td>
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<tr>
<td>ILS</td>
<td>Integrated Logistics Support</td>
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<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>ISD</td>
<td>In-Service Date</td>
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<td>ISO</td>
<td>International Standards Organisation</td>
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<td>ITEAP</td>
<td>Integrated Test, Evaluation and Acceptance Plan</td>
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<td>ITT</td>
<td>Invitation to Tender</td>
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<td>JSP</td>
<td>Joint Services Publication</td>
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<td>LFE</td>
<td>Learning From Experience</td>
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<td>MAP</td>
<td>Maritime Acquisition Publication</td>
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<td>MC</td>
<td>Military Capability</td>
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<td>MLU</td>
<td>Mid-Life Upgrade</td>
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<td>MOD</td>
<td>Ministry of Defence</td>
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<td>MODAF</td>
<td>Ministry of Defence Architectural Framework</td>
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<td>MODREC</td>
<td>Ministry of Defence Research Ethics Committee</td>
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<tr>
<td>MOTS</td>
<td>Military Off-The-Shelf</td>
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<tr>
<td>OPRR</td>
<td>Overarching People-Related Requirement(s)</td>
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<tr>
<td>PAS</td>
<td>Publicly Available Specification</td>
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<tr>
<td>PFI</td>
<td>Private Finance Initiative</td>
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<td>PPE</td>
<td>Personal Protective Equipment</td>
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<td>PRR</td>
<td>People-Related Requirement(s)</td>
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<td>Project Team</td>
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<td>Project Team Leader</td>
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<td>SMS</td>
<td>Safety Management System</td>
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<td>SME</td>
<td>Subject Matter Expert</td>
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<tr>
<td>SOR</td>
<td>Statement of Requirements</td>
</tr>
<tr>
<td>SPA</td>
<td>Single Point of Accountability</td>
</tr>
<tr>
<td>SQEP</td>
<td>Suitably Qualified and Experienced Person(s)</td>
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<tr>
<td>SOS</td>
<td>System of Systems</td>
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<tr>
<td>SOSA</td>
<td>System of Systems Approach</td>
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<tr>
<td>SRD</td>
<td>System Requirements Document</td>
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<tr>
<td>SRL</td>
<td>System Readiness Level</td>
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<td>SSE</td>
<td>Support Solutions Envelope</td>
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<tr>
<td>SSG</td>
<td>Sea Systems Group</td>
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<tr>
<td>TAD</td>
<td>Target Audience Description</td>
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<tr>
<td>TLCM</td>
<td>Through-Life Capability Management</td>
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<td>TLMP</td>
<td>Through-Life Management Plan</td>
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<tr>
<td>TNA</td>
<td>Training Needs Analysis</td>
</tr>
<tr>
<td>UCD</td>
<td>User Centred Design</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
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<tr>
<td>UOR</td>
<td>Urgent Operational Requirement</td>
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SECTION 1: GENERAL INFORMATION

Description of JSP 912

1.1 JSP 912 is issued for the purpose of promulgating MOD Policy with respect to the process of Human Factors Integration (HFI) in Defence Systems.

Objectives of JSP 912

1.2 The objectives of JSP 912 are to:

   a) Define MOD Policy with respect to the process of HFI in Defence Systems, together with requirements for the HFI process and its constituent activities;

   b) Provide focussed support to MOD personnel involved in HFI activities in acquisition projects, to ensure that the HFI activities are carried out effectively, efficiently and at appropriate times in a project;

   c) Guide those MOD Staff who provide advice to projects in support roles e.g. commercial and financial;

   d) Define the specific requirements for HFI activities to be undertaken by the Solution Provider\(^1\) in contract documentation. Comprehensive requirements for and guidance on such activities is provided in Def Stan 00-250 (Ref 1);

   e) Inform and guide other parties, such as Solution Providers, as to how the MOD approaches this aspect of Defence Acquisition, and therefore to better understand MOD internal processes and how these affect Defence Acquisition activities.

1.3 Def Stan 00-250 (Ref 1) provides additional guidance on activities to be undertaken by MOD staff to enable and facilitate other activities undertaken by the Solution Provider. Where MOD Staff responsibilities in this JSP are derived from the Overarching People-Related Requirements (OPRRs) in Def Stan 00-250, this is indicated by the citing of the relevant Def Stan 00-250 OPRRs reference number after the JSP requirement, e.g. [OPRR 999].

Applicability

1.4 The requirements of this JSP shall apply to:

   a) MOD Staff with responsibilities for programmes and projects that acquire and employ materiel e.g. infrastructure, vehicles, equipment, hardware, software, Personal Protective Equipment (PPE) and tangible forms of information. This includes a range of procurement options including Commercial off-the-shelf (COTS),

---

\(^1\) An organisation or an individual that enters into an agreement with the Acquirer for the supply of a product or service. This includes design, manufacture, test, supply and provision of the means to achieve a capability, together with ongoing through-life support.
Military off-the-shelf (MOTS) and Urgent Operational Requirements (UORs);

b) MOD Staff with responsibilities for projects that acquire goods, in-service support and other services to support Defence Capability;

c) Contracts that acquire Defence Capability, i.e. infrastructure, platforms, equipment, vehicles, hardware, clothing, PPE, software, prototypes, materiel and services.

Document Layout

1.5 Sections 1 - 12 of this document contain normative (mandatory) requirements on MOD Staff. The Appendix of this document is informative. This document should be used in conjunction with Def Stan 00-250 [Ref 1], Human Factors for Designers of Systems, which provides guidance to MOD on the execution of HFI within contracts.

Relationships between MOD HFI Documentation

1.6 This JSP shall be used in conjunction with other MOD HFI-related documentation as illustrated in Figure 1. For a list of referenced and supporting documents refer to APPENDIX A.

Definitions

1.7 The following key terms used in this document shall have the meanings given in Table 1. A list of other defined terms is given in APPENDIX B.

Table 1 Key Terminology

<table>
<thead>
<tr>
<th>Shall</th>
<th>A mandatory requirement that must be satisfied by the Solution or the process by which the Solution is achieved.</th>
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<tr>
<td>Should</td>
<td>An advisory statement that should be satisfied by the Solution or the process by which the Solution is achieved wherever practicable and cost-effective.</td>
</tr>
<tr>
<td>May</td>
<td>A discretionary statement that may be applied if relevant to the context.</td>
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Channel for Comments

1.8 This JSP is sponsored by EG, DTech, DE&S. Enquiries or proposed changes should be sent to the address below.

EG,
Human Factors Integration Policy
ELM1a #4125
MOD Abbey Wood
Bristol
BS34 8JH
Phone number: 030 679 37553

2 The totality of equipment and people that provides a required capability.
JSP 912
Human Factors Integration for Defence systems
Defines MOD Policy with respect to HFI. Specifies: MoD Staff Responsibilities, HFI Process Goals, HFI activities, process monitoring and HFI maturity assessment.

Defence Standard 00-250 Human Factors for Designers of Systems
Part 0 Human Factors Integration
Provides MOD Personnel and Industry with guidance on the MOD HFI ‘process’ which members of the MOD’s Project teams should use in managing the people related considerations in both new systems and enhancements to existing systems.

Defence Standard 00-250 Human Factors for Designers of Systems
Part 1 Overarching People-Related Requirements
Provides MOD staff with a set of formal People-Related Requirements and associated compliance means that are to be included in all Defence acquisition contracts to ensure HFI is properly addressed by Solution Providers.

Defence Standard 00-250 Human Factors for Designers of Systems
Part 2 Particular People-Related Requirements
Provides MOD staff with a set of particular People-Related Requirements and associated compliance means that may be included in all Defence acquisition contracts to ensure HFI is properly addressed by Solution Providers.

Defence Standard 00-250 Human Factors for Designers of Systems
Part 3 Technical Guidance
Provides Solution Providers and MOD staff with a suite of best practice, technical guidance and data to support the design and realisation of Solutions.

Defence Standard 00-250 Human Factors for Designers of Systems
Part 4 HFI Methods, Tools & Techniques
Provides Solution Providers and MOD staff with an overview of a range of HFI methods, tools and techniques that may be used to support Solution design and acceptance.

Service-Specific HFI Technical & Management Guides
- Land
  - Def Stan 00-25 Part 14
- Air
  - JSP 500 series
  - Def Stan 00-970
- Maritime
  - SSG MAP-01-010
  - SSG MAP-01-011
- MoD Process standards e.g.
  - Def Stan 00-56

Figure 1 Relationship between MOD core HFI Documents [Ref 1-6]
Disclaimer

1.9 Nothing contained within this JSP removes the responsibility of any duty holder to comply with the law and Ministry of Defence (MOD) requirements.

Warning

1.10 The MOD, like its contractors, is subject to both United Kingdom and European laws regarding Health and Safety at Work. Adherence to those processes and procedures in this JSP in no way absolves users from complying with legal requirements relating to Health and Safety at Work, as set out in JSP 375[Ref 7].
SECTION 2: MOD HUMAN FACTORS INTEGRATION (HFI) POLICY

2.1 In all systems that provide Defence Capability, the Equipment Component and the People Component shall be satisfactorily integrated such that:

a) The roles assigned to people in the Solution enables required system performance to be achieved under all conditions of use;

b) The design and realisation of the Solution:
   i  Makes best use of human capabilities (physical, cognitive, psychological and social characteristics);
   ii Recognises and provides for human needs;
   iii Provides mitigations for human limitations;
   iv Uses people in ways that maximise system safety [Ref 5][Ref 6];
   v  Uses people cost-effectively;
   vi Optimises whole-life costs due to the use of people.

2.2 MOD staff (and Solution Providers under contract to the MOD) shall adopt a systematic and comprehensive risk-based approach towards Human Factors Integration (HFI) in all projects.

2.3 The scope, extent, depth, complexity and thoroughness of all HFI activities to be undertaken, shall be determined against considerations of risk to the required project and programme outcomes presented by People-Related considerations (APPENDIX C). These will be typically measured in terms of capability goals, objectives, cost, time, system performance, system safety and system usability.

2.4 This HFI policy shall be implemented from the outset of all Defence Capability development, where early decisions on MOD requirements, concepts of use, system design, system constraints and assumptions will determine the ultimate effectiveness of the system.

2.5 The Policy shall be applied throughout the life of the capability.
SECTION 3: INTRODUCTION TO HFI

Why Consider the People Component of Capability?

3.1 Although many Defence Acquisition projects are concerned with the acquisition of technology (i.e. infrastructure, platforms, equipment, hardware, software), even in so-called unmanned systems such tangible items must be operated, maintained and supported by people. Thus whatever their nature, degree of complexity or technological sophistication, systems that provide Defence Capability comprise of:

   a) Infrastructure, equipment, hardware, software, information and material necessary to deliver the required capability (referred to collectively in this document as the 'Equipment Component') and;

   b) MOD Service personnel and Civilian support staff, together with the organisations, the structures in which people work, human behaviours and much of the information with which people work (referred to in this document as the ‘People Component’).

3.2 It is recognised that a failure to consider the People Component of Capability can result in:

   a) Increased accidents and incidents;

   b) Greater training costs;

   c) Reduced performance and mission effectiveness;

   d) Breaches in duty of care;

   e) A scarcity of appropriately skilled personnel;

   f) Substantial increases in design / redesign costs.

3.3 To achieve the required capability, both of these components must work in close combination and harmony. The effectiveness and efficiency of the resulting system, or a constituent part, may depend critically on the People Component and the adequacy of this combination. Of critical importance is that the People and Equipment components must be effectively integrated TOGETHER. Approaches that seek to integrate the People Component INTO the Equipment Component shall not be used.

3.4 These components are typically linked by operational, organisational and management processes as illustrated in Figure 2. The approach that balances human and technology needs is known internationally as "Human-Centred Design".

3.5 The process by which the Components of Defence Capability are brought together and made to work in Defence systems is known as Human Factors Integration (HFI). HFI is primarily concerned with the overlap between the three components as illustrated by the shaded area in Figure 2.
What are HFI Domains?

3.6 HFI involves the identification and trade-off of people-related considerations that could affect capability development and delivery. To ensure all relevant dimensions are considered a framework of seven HFI domains is used:

- a) Manpower
- a) Personnel
- b) Training
- c) Human Factors Engineering
- d) System Safety
- e) Health Hazards
- f) Social & Organisational

3.7 The HFI domains allow for all aspects of human behaviour, capability and limitations to be address e.g. from interactions with the physical environment to understanding cultural differences in groups. Importantly the HFI domains are related to each other and should not be considered in isolation. Any decision in one of the domains can easily affect another domain. For example, where the level of automation is increased there may be a change in required staffing levels, and vice versa.

3.8 At the simplest level asking ‘are there concerns relating to this domain?’ can help identify what needs to be considered and ultimately priorities as high, medium and low risk to the overall programme. This should form a natural part of the project’s risk management activity.

3.9 The HFI domains provide an alternative perspective on the system under development compared with the DLODs. The domains were developed originally to support management of key human risks in the design process particularly the human interaction with the hardware/software elements of the system. More recent developments have included the
inclusion of the ‘social & organisational’ domain to encompass a greater breadth of human considerations. The domains do not replace the DLODs they complement them.

What is an HFI Process?

3.10 HFI is a systematic process for identifying, tracking and resolving People-Related considerations ensuring a balanced development of both technologies and human aspects of capability.

3.11 The HFI process reflects agreed Systems Engineering practice as defined in International Standards and follows accepted Human Factors (HF) good practice in the management and mitigation of People-Related issues and risks in projects. Affiliating HFI to Systems Engineering provides a consistent framework within which:

   a) Projects can systematically address People-Related considerations, consistent with good systems engineering practice;
   
   b) Process steps are associated with typical project phases, so providing a mechanism for monitoring performance;
   
   c) The importance of Learning From Experience (LFE) to improve future acquisitions is identified.

3.12 HFI is an integral part of Systems Engineering and shall be considered throughout the lifecycle of a system, e.g. when considering mid-life updates; the procurement of COTS products; and when defining and managing an in-service organisation. The unique characteristics of the people component of capability provide a challenge for systems engineers to manage, hence the requirement for additional guidance contained in this JSP.

Overview of MOD HFI Process

3.13 The HFI process specified in this document is both goal-based and risk-based. HFI process goals that must be satisfied in every project are detailed in Paragraph 6.6. Provided these goals are achieved, the means by which they are achieved can be tailored to the circumstances of individual projects across land, sea and air domains. As a consequence, the extent and depth of HFI activities (Sections 7-12) should be tailored to the degree of project risk presented by People-Related considerations (APPENDIX C). In this way, the process supports the development of cost-effective systems that meet stakeholder requirements.

3 The term "good Human Factors practice" shall be understood to represent practices that are widely agreed between Human Factors professionals to be optimal for their purpose. In some cases, such good practices are enshrined in published standards, e.g. ISO 9241-210 [Ref 8]. The existence of an agreed good practice does not in itself guarantee success. The practice must be both appropriate to its application and applied appropriately. To achieve these objectives, professional Human Factors input and/or guidance may be required.

4 For more information see Section 6 and APPENDIX D.
3.14 Given the range and diversity of Defence systems, there is no single set of HFI activities that can be prescribed to always achieve HFI (APPENDIX D). At the detailed level, the set of HFI activities must be devised for each Capability Acquisition project. This JSP defines the required approach to identifying the right set of HFI activities, undertaking these, and assessing the resulting maturity of the emergent Solution.

3.15 The process also identifies how HFI can contribute to typical MOD project outputs without imposing onerous demands in terms of unnecessary additional documentation. These outputs include:

a) Programme Management;

b) Risk Management;

c) Through-Life Management Plan (TLMP);

d) Integrated Test, Evaluation and Acceptance Plan (ITEAP).

3.16 HFI is an integral part of Systems Engineering and addresses the risks (both threats and opportunities) associated with the People Component of Capability within the Through Life Capability Management (TLCM) framework.

3.17 Within the context of TLCM, the People Component of Capability has an influence upon all Defence Lines Of Development (DLOD). Importantly, People Considerations are to be found in all DLODs (Paragraph 7.11), not confined to the Personnel and Training DLODs.

3.18 The people component is very often an element of multiple capabilities involving interactions within systems forming ‘Systems of Systems’. An overview of the issues involved in the acquisition of Systems of Systems is provided in APPENDIX E. For more extensive guidance see JSP 906 [Ref 9].
SECTION 4: MOD STAFF RESPONSIBILITIES

4.1 This JSP shall apply to ALL MOD STAFF IN ALL PHASES of the system lifecycle, from early concept through to equipment disposal / service termination, particularly:

a) Capability Sponsors;
b) Project / Delivery Teams;
c) Specialist Safety and Engineering Functions;
d) End users;
e) Capability Stakeholders, e.g. Principal Personnel Officers.

Project Team Leader Responsibilities

4.2 The Project Team Leader (PTL) shall have prime responsibility for ensuring that HFI is successfully managed in a project, and that satisfactory HFI outcomes are achieved.

4.3 The PTL shall nominate a member of the Project Team (PT) to undertake responsibility for day-to-day management of HFI activities relating to the project, including both those carried out by the MOD and those carried out by others on behalf of the MOD. This document uses the term Human Factors Integration Focus (HFIF) for the person which is consistent with previous documentation.

4.4 The PTL shall ensure that MOD Staff who undertake HFI management activities are provided with sufficient information and training to enable them to undertake their responsibilities.

DE&S Support Functions Responsibilities

4.5 DE&S Support Functions shall provide information, guidance and support to MOD HFI Staff within PTs.

Human Factors Integration Focus (HFIF) Responsibilities

4.6 The Project HFIF shall ensure that the requirements of this document are implemented and that a suitably tailored HFI process (Section 6) is devised appropriate to the project characteristics (APPENDIX C, APPENDIX D) and applied by all MOD Staff and by Solution Providers undertaking HFI activities on behalf of MOD.

Additional Information

4.7 Nothing contained within this JSP removes the responsibility of any duty holder to comply with health and safety legislation and MOD policy.
SECTION 5: HFI RESOURCE COMPETENCIES

MOD Staff HFI Competencies

5.1 The target competence for the HFIF shall be Practitioner level. The HFIF shall have, as a minimum, the competence of Awareness, gained through basic training and study of available materials.

5.2 ALL MOD STAFF undertaking HFI activities shall be Suitably Qualified and Experienced Persons (SQEP). Resources may be drawn from:

   a) Specialist MOD staff within the DE&S e.g. the Human factors Integration Group (HFIG);
   b) Specialist MOD staff within Defence Science and Technology Laboratory (Dstl), e.g. Human Systems Group (HSG);
   c) Specialist MOD staff from the Institute of Naval Medicine (INM);
   d) Specialist HF staff from within Industry supporting the MOD (acting as ‘customer friend’).

Solution Provider HFI Competencies

5.3 All HFI activities carried out by Solution Providers shall be carried out by SQEP. Where HF resources are drawn from Industry, it is preferred that they should be either:

   a) A UK Institute of Ergonomics and HF (IEHF) Registered Consultancy, or;
   b) Their activities should be led by or overseen by an IEHF Registered Ergonomist.

5.4 Where these target criteria cannot be met, the HFIF shall ensure that HFI Solution Provider’s HFI resources are SQEP. For many HFI activities, this requirement will not be onerous. However, depending on their nature, some HFI activities need to be done by a Professional Ergonomist (HF Specialists), or a person with considerable experience of undertaking HFI in a Defence context\(^5\).

5.5 Other activities, such as identification and analysis of context of use information do not have to be carried out by a HFI professional, and should be supported by a Military domain expert.

\(^5\) An example of such an activity is Early Human Factors Analysis (EHFA). To be effective, EHFA needs to be systematic and comprehensive but not necessarily carried out in-depth. The goal is to identify key HFI considerations. It is impractical to define a unique process for EHFA. Any mechanistic approach would be difficult to define, if not impossible, too time consuming and too costly. EHFA often benefits from a quasi-intuitive approach, based on wide experience of applying HFI in project situations.
Ethical Conduct Competencies

5.6 Activities that involve experiments or assessments with human participants shall comply with JSP 536: Ethical Conduct and Scrutiny in MOD Research involving Human Participants [Ref 10]. In addition, some such studies may need to conform to the British Psychological Society Ethical principles for conducting research with human participants, 2011 [Ref 11] and the IEHF Professional Code of Conduct [Ref 12]. In such cases, the involvement of a SQEP shall be essential.
SECTION 6: HFI PROCESS

Scope of HFI Process in JSP 912

6.1 This JSP prescribes a set of high-level HFI activities that are applicable to all types of Capability Acquisition projects, Figure 3 and APPENDIX D, illustrate these activities. However, given the range and diversity of Defence Capability Acquisition projects, this JSP does not prescribe a single set of detailed HFI activities. For example in Figure 3, the development of the User Requirements Documents (URD), System Requirements Documents (SRD) and Statement of Solution are assumed to be undertaken ‘in-house’ by MOD with ‘the contract’ being placed for iterative development of the solution. Alternative acquisition processes may involve contractors being employed to support the requirements development process, in which case the contracts for this support will need to address how the People Components are to be captured, defined, tested etc.

6.2 The range and depth of detailed HFI activities to be undertaken for a given project shall be determined by considering those risks associated with the People Component of Capability, People-Related Requirements (PRRs) and HFI goals as specified in this JSP and the characteristics of the project. APPENDIX D, Figure 11, provides an overview of typical HFI technical activities, related to a generic system lifecycle that will need to be undertaken in order to adequately address HFI. This process should be tailored according to the procurement strategy defined for the project. For example, the process for contracting for a service will vary compared to that for contracting for a system purchase.

6.3 Sections 7 - 12 provides further guidance on how such typical activities are related to the generic system lifecycle model adopted by this document (Figure 3). APPENDIX D provides guidance on how HFI activity maturity may be assessed against a set of HFI goal maturity indicators.

MOD HFI Process

6.4 MOD Staff shall organise and conduct all HFI activities within Defence Capability Acquisition projects systematically. HFI activities shall be aligned with individual contract phases, for example: Pre-Contract HFI Activities, Contract Placement HFI Activities, In-Contract HFI Activities and Post-Contract Activities as illustrated in Figure 3. The HFI Activity Stages are presented in more detail in APPENDIX F.

6.5 HFI technical and management activities shall be aligned with regard to the actual project lifecycle used. This document assumes a generic high-level lifecycle model that supports MOD systems engineering processes and practices. Figure 3 illustrates how the High-Level HFI process and generic lifecycle model map onto the Concept, Assessment, Design, Manufacture, In-service, Disposal (CADMID) cycle.
Figure 3 MOD HFI Process and a System Lifecycle model mapped onto the CADMID cycle
HFI Process Goal

6.6 In all MOD Capability Acquisition projects, the following HFI goals\(^6\) shall be fully pursued to achieve satisfactory outcomes. All HFI activities that are undertaken shall relate to and support one or more of the itemised goals:

   a) Planned and managed consideration of HF and People-Related considerations (including risks, issues, constraints, assumptions etc) from the very outset of a project, and subsequently throughout the lifecycle.

   b) Systematic, rigorous and formal capture, specification and management of PRRs necessary to provide the required Capability (see APPENDIX G).

   c) The adoption of a User-Centred Design (UCD) approach as defined in ISO 9241-210:2010 [Ref 8], or an agreed variant where such is agreed to be more appropriate to the project strategy.

   d) The use of established HF principles, accepted best practice, and suitable methods, tools and techniques and data.

   e) Design to match the Context of Use.

   f) Design to match User Characteristics.

   g) Design to match User Organisation characteristics.

   h) Design to meet User needs.

   i) Adoption of a multi-disciplinary approach.

   j) Involvement of Users in system and equipment design and evaluation.

   k) The iteration of design solutions so as to optimise the Solution against People-Related Requirements and People-Related Constraints.

   l) Formal scrutiny, assessment and acceptance of HF aspects of the Solution.

6.7 These high-level goals can be viewed as a hierarchical set, achieved through a series of sub-goals, activities and data in-feeds. Figure 4 illustrates this hierarchy.

6.8 When each of the individual goals, sub-goals and high-level goals have been satisfactorily addressed, a project may claim that HFI has been satisfactorily achieved.

\(^6\) (derived from ISO 9242-210:2010 [Ref 8] and BS EN ISO 6385-1 [Ref 13].)
Figure 4 Hierarchical HFI Goal Structure
SECTION 7: PRE-CONTRACT HFI ACTIVITIES

Figure 5 MOD HFI Activities to be Performed Pre-Contract

Establish HFI Baseline

7.1 This section constitutes those activities relating to ‘Establish HFI Baseline’ (see Figure 3 and Figure 5). For goal, rationale and success criteria (see APPENDIX D, Table 3).

Establish Concepts and Objectives

7.2 The HFIF shall ensure that all project objectives, assumptions and constraints relevant to the People Component are identified, collated, and disseminated to MOD stakeholders and the Solution Provider(s) via contract and project documentation.
Produce HFI Strategy

7.3 The HFIF shall ensure that the HFI strategy will, in broad terms, clarify the project approach to HFI:

   a) Who will manage it;
   b) Who will undertake the work;
   c) When it will be done.

7.4 The HFI activities will be aligned with the procurement strategy adopted for the project. This will facilitate easy transition through Initial Gate, Main Gate and final acceptance.

Produce HFI Plan (HFIP)

7.5 The HFIF shall ensure that the HFIP for the project is produced as soon as possible. Details of the minimum content are listed in APPENDIX H of this document. The HFI Strategy should be included within the HFIP.

Establish Context of Use

7.6 The HFIF shall ensure that information to describe the context of use for the required Solution has been disseminated to MOD HF stakeholders, and to the Solution Provider(s) via contract and project documentation. The process of arriving at a satisfactory level of information to support Solution design may require a high degree of co-operation between the Acquirer and the Solution Provider.

Identify Operational Modes and Scenarios

7.7 The HFIF shall ensure that information to describe operational scenarios for the required Solution (e.g. Concept of Operations (CONOPS), Use Cases) are created, collated and disseminated to MOD HF stakeholders, and to the Solution Provider(s) via contract and project documentation.

Analyse Legacy System Data and Feedback

7.8 The HFIF shall ensure that the project and operational databases for the capturing of lessons identified are examined. Learning from lessons identified is a through life process which has input into Capability planning, delivery, generation and operation.

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7 A use case is a methodology used in system analysis to identify, clarify, and organize system requirements. The use case is made up of a set of possible sequences of interactions between systems and users in a particular environment and related to a particular goal. It consists of a group of elements (for example, classes and interfaces) that can be used together in a way that will have an effect larger than the sum of the separate elements combined. The use case should contain all system activities that have significance to the users. A use case can be thought of as a collection of possible scenarios related to a particular goal, indeed, the use case and goal are sometimes considered to be synonymous.
Define User Population and Characteristics

7.9 The HFIF shall ensure that the physical, psychological and social characteristics of the intended User population for the required Capability are identified, described and documented. A typical vehicle for communicating the characteristics of the User population to Solution Providers is a Target Audience Description (TAD).

7.10 The HFIF shall ensure that information to describe the physical, psychological and social characteristics of the User population are disseminated to MOD Stakeholders and to the Solution Provider(s) via contract and project documentation.

Early Human Factors Analysis (EHFA)

Conduct EHFA

7.11 The HFIF shall ensure that an EHFA is conducted by SQEPs or Organisations. The EHFA shall be a high-level, but fully comprehensive and balanced analysis of the People-Related aspects of the Project across all DLODs. The DLODs are:

   d) Training;
   a) Equipment;
   b) Personnel;
   c) Information;
   d) Doctrine and Concepts;
   e) Organisation;
   f) Infrastructure;
   g) Logistics.

7.12 The analysis may require disparate Project data to be extracted, collated or synthesised and may require significant input from the Single Point of Accountability (SPA) or his/her nominee.

7.13 The output from the EHFA shall include a prioritised list of key People-Related considerations including risks, issues, constraints, assumptions, supported by evidence and expert judgement.

7.14 An initial EHFA shall be conducted before the Concept phase is complete, ideally as soon as possible in the project lifecycle.

7.15 The Initial EHFA shall be updated or expanded if the process of project maturing indicates such a need.

Identify and Document People-Related Considerations

7.16 The HFIF shall ensure that People-Related considerations are identified and captured.
Create HFICR

7.17 The HFIF shall ensure that People-Related considerations are recorded in a structured Human Factors Integration Considerations Register (HFICR).

7.18 Pre-contract, the contents of the HFICR shall be reviewed regularly with stakeholders and the contents of the HFICR should be maintained and up to date.

Assess and Manage People–Related Project Risks

7.19 The HFIF shall ensure that HFI risks derived from the HFICR are fed into the Project Risk Register and the Hazard Log, and that they are subsequently managed to a satisfactory outcome.

People-Related Requirements (PRRs)

Identify and Document People-Related Assumptions and Constraints

7.20 The HFIF shall ensure that People-Related Assumptions for the Solution are systematically identified, captured, owned and managed via the HFICR.

7.21 Where an acquisition project employs the MOD Architectural Framework (MODAF), the HFIF shall ensure that people related aspects of the system are captured. One mechanism for doing this is through MODAF ‘Human Views’. See the guidance provided at APPENDIX I.

Identify and Document PRRs and Compliance Measures and Priorities

7.22 The HFIF shall ensure that People-Related Considerations captured in the HFICR are addressed by PRRs.

7.23 The HFIF, working in close collaboration with Project Stakeholders and Subject Matter Experts (SMEs), shall ensure that PRRs are identified and captured. APPENDIX G provides essential guidance on this topic. Additional guidance on managing PRR is provided in Def Stan 00-250.

7.24 Identified PRRs shall be organised into three categories:

a) Overarching PRRs (OPRRs);
b) Service-Specific PRRs;
c) Capability Configuration-Specific (i.e. solution specific) PRRs.

7.25 For each agreed PRR, the HFIF shall ensure suitable compliance means are established and documented (see APPENDIX J).

7.26 The HFIF shall ensure that for each identified PRR, the following attributes are identified and agreed between Stakeholders and SMEs:

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*PRRs are contained in Def Stan 00-250, Part 1 and 2.*
a) Ownership;
b) Priority (including whether mandatory, essential or key);
c) Tradability (absolute and inter-requirement);
d) Acceptable means of demonstrating compliance.

7.27 The HFIF shall ensure that Service-Specific PRRs are documented and agreed with the Personnel DLOD owner.

7.28 The HFIF shall ensure that all agreed PRRs are prioritised to the satisfaction of stakeholders.

Conduct Trade-Offs

7.29 The HFIF shall ensure that trade-offs between competing or conflicting PRRs are conducted by Stakeholders and such conflicts resolved satisfactorily.

Incorporate PRRs into Contract Specifications

7.30 The HFIF, working in close collaboration with Project contract management staff, shall ensure that the OPRRs contained in Def Stan 00-250 Part 1 are included in their entirety in relevant Contract Specification and Enquiry documentation. Tenderers, as required by Contract documentation, shall respond to each requirement [OPRR 1].

7.31 (Note that the reference to Part 1 MUST be included. It is not appropriate or meaningful to require Providers to comply with all parts of Def Stan 00-250).

7.32 The HFIF, in conjunction with relevant MOD Stakeholders and SMEs, shall review the Particular PRRs contained in Def Stan 00-250 Part 1. Those requirements that are deemed appropriate and beneficial shall be included in contract documentation as Capability Configuration-Specific PRRs. The PRRs contained in Def Stan 00-250 Part 1 should be tailored to project-specific needs.

7.33 The HFIF, working in close collaboration with Project Contract Management staff, shall ensure that all agreed Service-Specific PRRs are included in relevant Contract Specification and Enquiry documentation, and that Tenderers are required to respond to each requirement [OPRR 5].

7.34 The HFIF, working in close collaboration with Project Contract Management staff, shall ensure that any Capability Configuration-Specific PRRs are included in relevant Contract Specification and Enquiry documentation, and that Tenderers are required to respond to each requirement [OPRR 6].
SECTION 8: CONTRACT PLACEMENT HFI ACTIVITIES

Support Solution Provider Selection Process

8.1 The HFIF shall ensure that Contract Specification and Enquiry documentation requires prospective Solution Providers (Tenderers) to provide a HFIP detailing their proposed approach to HFI and all activities to be carried out to achieve successful HFI.

8.2 The HFIF shall support the Solution Provider selection process through performing the following activities.

Assess Tenderer’s HFIP

8.3 The HFIF shall ensure that Tenderers submit an HFIP. The HFIF shall review the Tenderer’s HFIP and assess its suitability to Project needs. The HFIP shall embrace all HFI activities to be conducted by the Solution Provider (Contractor) and shall also detail how HFI activities conducted by the supply chain are to be identified and managed. Supply chain HFI activities may be included in the Solution Provider’s HFIP, or they may be detailed in subsidiary plans, which are then to be identified and inter-related to the main HFIP. Tendered HFIPs shall, as a minimum, address the topics listed in APPENDIX H [OPRR 11].

8.4 The HFIF shall also assess the inter-relationships between the Tenderer’s HFIP and other Project plans to determine that sufficient links between plans are established. The HFIF shall advise the PTL of the acceptability of the Tenderer’s HFIP and any consequent project risk [OPRR 10].

Assess Proposed HF Methods and Tools

8.5 The HFIF, working in close collaboration with relevant SMEs, shall ensure that HFI considerations arising from Tenderer’s proposed HFI activities and use of HFI methods and tools are assessed and that such assessments are adequately reflected in all deliberation and decision-making with regard to the selection of a Solution Provider.
Assess Tenderers’ Compliance Statements and Staff Competencies

8.6 The HFIF shall scrutinise all HFI Compliance Statements submitted by Tenderers and shall assess their validity. This will include assessing the competencies of the Tenderer’s personnel to undertake the planned HFI activities.

Assess People-Related Project Risks

8.7 The HFIF shall consider any proposals made by Tenderers for derogations (i.e. dispensations) from the need to comply with OPRRs contained in Def Stan 00-250 Part 1 and shall advise the PTL of any consequent project risks [OPRR 2] [OPRR 3]. The HFIF shall ensure that the impact of such proposals is determined on the basis of evidence provided by Tenderers.

8.8 The HFIF shall ensure that all HFI activities are identified and planned so as to ensure cost-effective use of resources taking into account project risk. The factors to be taken into account as minimum when assessing risk are:

a) Project Size (≈ Monetary Value);
b) Diversity of Requirements;
c) Maturity of Requirements;
d) Technological Novelty;
e) Conceptual Novelty;
f) Technological Complexity;
g) Organisational Complexity;
h) User Population Characteristics;
i) Procurement Strategy.

8.9 See APPENDIX C for guidance on the assessment of such risks.
SECTION 9: IN-CONTRACT HFI ACTIVITIES

In-Contract Activities

Iterative Solution Development

- HFI Activity Planning
- HFI Activity Management
- Solution Acceptance
- People-Related Requirements & Considerations
- Concept of Use Information
- Population Characteristics
- Solution Design & Realisation
- HF Trials & Experimentation
- HF Design Audits
- HF Analyses
- Inputs to Project Documentation

Figure 7 MOD HFI Activities to be Performed In-Contract

Iterative Solution Development

HFI Activity Planning

9.1 The HFIF shall ensure that the high-level Contract HFIP identifying and defining all agreed HFI activities is implemented.

9.2 The HFIF shall ensure that HFIPs are periodically reviewed and where necessary updated by the Plan producer throughout the Contract.

9.3 Where the Solution is provided by a number of Solution Providers or by a number of part-Solution Providers contracted to a principal Solution Provider, the HFIF shall ensure that individual lower-level HFIPs produced by
Solution Providers are satisfactorily synchronised, integrated or interlinked. Responsibility for integration of individual HFIPs is typically assigned to the principal Solution Provider through contract documentation. Where prime system integration rests with MOD, competent MOD staff will be required to integrate individual HFIPs. This is likely to increase the risk carried by MOD.

HFI Activity Management

9.4 The HFIF shall establish a HFI forum, the purpose of which shall be to bring together MOD Stakeholders, MOD SMEs, and Solution Provider HF staff. (It is not necessary for the HFIF to chair and run the meeting, this task may be delegated to the supplier.) The usual title for such a forum is the HFI Working Group (HFIWG). A model set of HFI Working Group Terms of Reference are given in APPENDIX K.

9.5 The HFIWG shall meet on a regular basis, at a frequency determined by Project requirements and timescales (at a minimum quarterly).

9.6 The HFIWG shall consider a standard agenda that encompasses its Terms of Reference, supplemented by other matters arising.

9.7 The HFIWG shall manage all HFI considerations arising from the design and realisation of the Solution [OPRR 18].

People-Related Requirements and Considerations

9.8 The HFIF shall ensure that all people-related considerations, including: emergent assumptions, constraints, user needs, risks, associated mitigations, opportunities and outcomes that arise during the design and realisation of the Solution shall be recorded in a suitable form. The People-Related Considerations Register shall be maintained throughout the duration of the contract and shall form part of the contract deliverables. An acceptable vehicle for recording such issues is a HFICR. The HFICR may be created and maintained by MOD Staff or by a Solution Provider [OPRR 14].

9.9 The HFIF shall ensure that Stakeholders, SMEs and Solution Providers’ staff engage in systematic and iterative dialogue to agree the content of the HFICR and to achieve agreed outcomes for all recorded items [OPRR 15].

9.10 The People-Related Considerations in the HFICR shall be managed to the mutual satisfaction of the Project Stakeholders before the system is accepted into use.

9.11 The HFIF shall ensure that the Solution Provider(s) have reasonable access to MOD Stakeholders and SMEs, including those who can represent actual system users, maintainers and supporters.

9.12 MOD Stakeholders and SMEs shall provide guidance to the Solution Provider(s) on the required interpretation of PRRs.

9.13 MOD Stakeholders and SMEs shall provide guidance to Solution Provider(s) on the viability of proposed Solutions.
9.14 The HFIF shall ensure that effective arrangements are made for relevant Stakeholders, SMEs and User representatives to take part in requirements trade-off and solution trade-off decision-making [OPRR 27].

9.15 Where, as a result of developing a Solution, a Solution Provider identifies conflicting PRRs, MOD Stakeholders shall engage co-operatively in design trade-offs to resolve such conflicts to the satisfaction of the MOD Accepting Authority(ies).

9.16 The HFIF shall ensure that any proposals made by the Solution Provider for changes to the expected context of use, employment or operation likely to bring operational or cost-of-ownership benefits to the Acquirer are fully considered and reviewed. The HFIF shall advise the Solution Provider of the acceptability of such proposals [OPRR 26].

9.17 The HFIF shall consider and manage all recorded People-Related considerations associated with the Solution that fall beyond the Solution Provider's remit to manage [OPRR 17].

Concept of Use Information

9.18 The HFIF shall ensure that Solution Providers utilise adequate information describing the Context of Use, Concept of Employment and Concept of Operations for the Solution [OPRR 25]. Such information shall include:

a) Existing user organisation people structures;

b) Existing user organisation user types;

c) Existing user organisation customs and practices;

d) Existing user organisation concepts and doctrines;

e) Existing user roles, responsibilities and work management hierarchies;

f) Existing user's terms and conditions of employment.

9.19 Where Context of Use information must be provided from MOD sources, the HFIF shall ensure that such information is collated and disseminated to the Solution Provider when required by the Contract programme.

9.20 The HFIF shall identify and collate any feedback from relevant MOD Legacy System operation, maintenance and support and shall make this available to the Solution Provider when required by the Contract programme.

9.21 Where Context of Use information must be managed by the Solution Provider, the HFIF shall ensure that such information captures all relevant MOD sources.
Population Characteristics

9.22 The HFIF shall ensure that information describing the physical, psychological and social characteristics of the Users\(^9\) (operators, maintainers and supporters) that is required to implement the design and realisation of the Solution is available to Solution Providers. This information may be communicated in the form of a TAD produced by or on behalf of the MOD, or it may be created as an element of the contracted Solution [OPRR 30] [OPRR 43]

9.23 The HFIF shall agree with the Solution Provider the extent and form of any User Population characteristics data to be used in the design of the Solution [OPRR 47].

9.24 The HFIF shall agree with the Solution Provider any proposals to acquire or synthesise additional User Population characteristics data required to design and realise the Solution [OPRR 48].

9.25 The HFIF shall make available to the Solution Provider any relevant human performance data from MOD sources [OPRR 54]. Such data shall include human reliability data where this is available.

9.26 The HFIF shall ensure that any User Population characteristics performance criteria that are proposed by the Solution Provider and that are agreed to be necessary to ensure the safe operation, maintenance and support of the Solution are passed to the relevant MOD Stakeholders and Authorities [OPRR 58].

9.27 The HFIF shall ensure that any personnel selection criteria that are proposed by the Solution Provider and that are agreed to be necessary to ensure the safe operation, maintenance and support of the Solution are passed to the relevant MOD Stakeholders and Authorities.

9.28 The HFIF shall ensure that any User Population skill, knowledge and experience requirements that are proposed by the Solution Provider and that are agreed to be necessary to ensure the safe operation, maintenance and support of the Solution are passed to the relevant MOD Stakeholders and Authorities [OPRR 61].

9.29 The HFIF shall ensure that any operator training considerations (including training needs) that arise from the design and realisation of the Solution are passed to the relevant MOD authorities [OPRR 69] [OPRR 70].

9.30 The HFIF shall ensure that any proposals made by the Solution Provider for changes to the operator population or their characteristics that are expected to bring operational or cost-of-ownership benefits to the Acquirer are fully considered and reviewed. The HFIF shall advise the Solution Provider of the acceptability of such proposals [OPRR 49].

\(^9\) Information on user characteristics may be available from previous projects. Where new information is compiled the potential for re-use in future projects should be considered and material made available in an accessible form.
Human Factors Trials and Experiments

9.31 Where it is necessary to employ HF methods that constitute experiments using human beings to develop the Solution, the HFIF shall ensure that all such activities conform to and adhere to the current version of guidelines for the conduct of such experimentation published by MOD in JSP 536 [Ref 10][Ref 8] (see Paragraph 5.6). In addition, some such studies may need to conform to the British Psychological Society Ethical Principles for Conducting Research with Human Participants, 2011 [Ref 11] and the IEHF Professional Code of Conduct [Ref 12].

Solution Design and Realisation

9.32 The HFIF shall ensure that the design and realisation process adopted by the Solution Provider is iterative. This calls for the Solution Provider to submit designs and proposal to the Acquirer for scrutiny and the provision of feedback and comment to the Solution Provider. Subsequent design submissions are then required to confirm the effects of Acquirer feedback and comments. Iterations are continued until all significant HFI considerations are resolved to the satisfaction of Stakeholders.

9.33 The HFIF shall ensure that the Solution Provider actively engages with MOD Stakeholders and SMEs in the design and realisation of the Solution as part of an iterative design process.

9.34 The HFIF shall ensure that the design and realisation process adopted by the Solution Provider takes into account Context of Use, User Population, individual and organisational characteristics and user needs (see ISO 9241-210:2010 [Ref 8]).

9.35 The HFIF shall ensure that all PRRs are managed in accordance with agreed acceptance criteria.

9.36 The HFIF shall ensure that any proposals made by the Solution Provider for changes to the specified Context of Use and which may be beneficial to the MOD, particularly where these may bring operational or cost-of-ownership benefits to the Acquirer are fully considered and reviewed. The HFIF shall advise the Solution Provider of the acceptability of such proposals [OPRR 49].

Human Factors Analyses

9.37 The HFIF shall ensure that Solution Providers undertake appropriate HF Analyses to underpin the design and realisation of the Solution. Such analyses shall, to the extent be determined by HFI risk analysis. Examples of such analysis might include the following:

a) Task Analysis;

b) Workload Analysis;

c) Link Analysis;

d) Person-to-person Communications Analysis;
e) Person-to-machine Interaction Analysis;
f) Allocation of Functions Analysis (between People and Equipment);
g) Human Performance Analysis;
h) Human Reliability Analysis.

9.38 The HFIF shall ensure that the results of all HF Analyses are scrutinised by SQEP SMEs to determine their adequacy.

9.39 The HFIF shall ensure that the results of all HF Analyses are incorporated into the design and realisation of the Solution.

HF Design Audits

9.40 The HFIF shall ensure that suitable arrangements are made so that relevant Stakeholders, SMEs and User representatives take part in HF design audits at agreed stages in the contract against agreed criteria [OPRR 29].

Inputs to Project Documentation

9.41 As part of the iterative design and realisation of the Solution, the HFIF shall ensure that all necessary technical inputs are made to the MOD project documentation as required by the Project programme, including:

   a) Combined Operational Effectiveness and Investment Appraisal (COEIA);
   b) SRD;
   c) TLMP;
   d) Hazard Log;
   e) Safety Case;
   f) Safety Management System (SMS);
   g) Project Risk Register;
   h) ITEAP.

9.42 The HFIF shall ensure that all information relevant to the system safety provided by the Solution Provider are fully considered by MOD Safety specialist staff, and that such inputs are incorporated into the system Safety Case [OPRR 52].

9.43 The HFIF shall make available to the Solution Provider information to describe the project philosophy and required approach to Through-Life Management issues [OPRR 57].
Solution Acceptance

9.44 The HFIF shall ensure that the developed Solution is scrutinised against all PRRs in order to determine its acceptability.

9.45 The HFIF shall ensure that evidence of the acceptability of the Solution in relation to PRRs is documented. This may be achieved by a completed compliance matrix array that embraces all agreed PRRs, details of agreed compliance means for each requirement, together with cross-references to relevant evidence within documentation that describes the Solution. See the guidance on HFI acceptance issues at APPENDIX J.

9.46 The HFIF shall ensure that Stakeholders and SMEs are involved in acceptance of all HFI aspects of the Solution.
SECTION 10: POST-CONTRACT HFI ACTIVITIES

Figure 8 MOD HFI Activities to be Performed Post-Contract

Maintain HFI Documentation

10.1 The HFIF shall ensure that Key HFI Documents are maintained and are made available to other PTs. Key HFI Documents include:

   a) Safety Case;
   b) HFIP;
   c) TLMP.

Evaluate Project HFI Outcomes

10.2 The HFIF shall ensure that all HFI outcomes from the project are systematically identified, collated, agreed and recorded. Suitable arrangements to retain such records shall be put in place.

10.3 The HFI Working Group may provide a vehicle for monitoring People Related Considerations throughout the life of the system. This group may be re-configured to perform this function at the discretion of the PTL.

Provide feedback

10.4 The HFIF shall ensure that feedback from the HFI outcomes is made available to subsequent capability acquisition projects, MOD SMEs and MOD specialist functions via established LFE processes.
11.1 The HFI Process for Mid-Life Update follows that for the initial acquisition, suitably modified to take account of the reduced project scope and the focussed nature of the work. The HFI policy stated in this JSP and the fundamental principles on which it is based shall apply to all Mid-Life Capability Upgrade HFI Activities.

Revisit EHFA

11.2 The approach will be risk based, based on the output of revisiting the EHFA. This will determine the size and scope of subsequent HFI activities.

Establish HFI Baseline

11.3 The HFIF shall ensure that all Mid-Life Update project objectives, assumptions and constraints relevant to the People Component are identified, collated, and disseminated to MOD stakeholders, and to the Solution Provider(s) via contract and project documentation.

Capture PRRs from In-Service Feedback

11.4 At an early stage in the Mid-Life Update process, the responsible HFIF shall capture PRRs from:
   a) The HFI Baseline information;
   b) Feedback from relevant legacy projects.

Produce HFI Plan for Mid-Life Capability Upgrade

11.5 The HFIF shall ensure that an HFI Plan for Mid-Life Update is produced, agreed and disseminated to Stakeholders.
## SECTION 12: DISPOSAL HFI ACTIVITIES

### Disposal Activities

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Figure 10 MOD HFI Activities to be performed during Disposal

**Hazards to People**

12.1 The HFIF shall ensure that in developing Safety Cases for disposal of equipment relating to the Capability, all hazards to humans are identified and managed by MOD Safety specialist staff in accordance with MOD Safety Policies and procedures.

**Hazards Created by People**

12.2 The HFIF shall ensure that in developing Safety Cases for disposal of equipment relating to the Capability, all hazards that may be created by the activities of humans are identified and managed by MOD Safety specialist staff in accordance with MOD Safety Policies and procedures.

**Input to Disposal Safety Case**

12.3 The HFIF, working in close collaboration with MOD Safety Stakeholders and SMEs, shall monitor and confirm that People-Related Considerations are satisfactorily addressed within all Disposal Safety Cases relating to the Capability.
APPENDIX A References and Supporting Documents

References


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<th><strong>Document Title</strong></th>
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<tr>
<td>Def Stan 00-250: Human Factors for Designers of Systems, Parts 0 to 4 inclusive, 2008.</td>
<td>Def Stan 00-250 provides Human Factors principles, processes and technical guidance for Defence Solution Providers. Moreover, it contains formal People-Related Requirements (PRRs) for inclusion in Defence acquisition contracts. The standard subsumes material from Def Stan 00-25.</td>
</tr>
<tr>
<td>JSP 553: Military Airworthiness Regulations 2010.</td>
<td>Describes the principles and policy agreed by the Defence Aviation Safety Board (DASB) for the regulation of the Airworthiness of UK Military Aircraft.</td>
</tr>
<tr>
<td>JSP 375: MOD Health and Safety Handbook, 2010.</td>
<td>Provides instruction and guidance to the Line Manager on the policy, top-level organisation and arrangements by which the MOD ensures the maintenance of acceptable standards of health and safety throughout the organisation. The instructions apply to all members of HM Forces and MOD civilian employees, and to all activities carried out under the control of the Secretary of State for Defence.</td>
</tr>
<tr>
<td>Def Stan 00-56: Safety Management Requirements for Defence Systems, Part 1 Requirements, Issue 4, 2007</td>
<td>This part of the standard provides requirements for the management of safety. It is applicable to all types of Defence acquisition contract, and can be applied at all stages of the lifecycle.</td>
</tr>
<tr>
<td>Def Stan 00-56: Safety Management Requirements for Defence Systems, Part 1 Requirements, Issue 5, 2013.</td>
<td>This part of the standard is an interim.</td>
</tr>
<tr>
<td>Def Stan 00-56: issue 4, June 2007: Safety Management Requirements for Defence Systems, Part 2 Guidance on establishing Means of Complying with Part 1.</td>
<td>This part of the standard provides a guide to establishing a means of complying with the requirements for the management of safety contained in Part 1. The guidance is not mandatory.</td>
</tr>
<tr>
<td>JSP 906: Design Principles for Coherent Capability, 2011.</td>
<td>Contains nine design principles which have been developed to define the way MOD will make acquisition decisions for the benefit of Defence, rather than for each individual project, system or service. This encapsulates the System of System Approach (SOSA).</td>
</tr>
<tr>
<td>JSP 536: Ethical Conduct and Scrutiny in MOD Research involving Human Participants, 2011</td>
<td>Research involving human participants undertaken, funded or sponsored by the MOD must meet acceptable ethical standards. Ethical standards are upheld by the MOD Research Ethics Committees (MODREC). This JSP sets out the MOD instructions for the ethical conduct and treatment of human participants in MOD research (both clinical and non-clinical).</td>
</tr>
<tr>
<td>British Psychological Society, Code of Human Research Ethics, 2011.</td>
<td>Sets out a set of general principles that are applicable to all research contexts and are intended to cover all research with human participants.</td>
</tr>
<tr>
<td>Institute of Ergonomics and Human Factors (IEHF) Code of Professional Conduct.</td>
<td>A Code of Professional Conduct has been laid out by the IEHF (the Institute). Those members admitted to the Registers of the Institute, that is, Registered Members, Fellows and Registered Consultancies, are expected to</td>
</tr>
<tr>
<td>Standard/Handbook</td>
<td>Description</td>
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</tr>
<tr>
<td>ISO 9241-210: Human-centred design processes for interactive systems.</td>
<td>Provides requirements and recommendations for human-centred design principles and activities throughout the lifecycle of computer-based interactive systems.</td>
</tr>
<tr>
<td>BS EN ISO 6385: Ergonomic principles in the design of work systems, 2004.</td>
<td>Provides a basic ergonomic framework for professionals and others who deal with the issues of ergonomics, works systems and working situations.</td>
</tr>
<tr>
<td>An Introduction to System Safety Management and Assurance. Issue 3, 2011.</td>
<td>Introduction to system safety management concepts, terms and activities used within MOD.</td>
</tr>
<tr>
<td>Bruseberg, A. Dr., The Human Views Handbook, Human Views for MODAF, HFI DTC, 2011.</td>
<td>The Human View Handbook for Ministry of Defence Architectural Framework (MODAF) describes a set of Human Views (HVs) to be used as complementary elements to the MODAF. It aims to clarify the role of Human Factors (HF) when creating Enterprise Architectures in support of acquisition – in order to facilitate both Human Factors Integration (HFI) and Systems Engineering. HVs aim to enable better integration across all the Defence Lines of Development (DLODs) and to aid Through Life Capability Management (TLCM).</td>
</tr>
<tr>
<td>BS ISO/IEC 15288: Systems Engineering – System lifecycle processes, 2002.</td>
<td>Provides a definition of the system lifecycle that can be used to underpin the technical activities associated with system acquisition and on to which HFI management activities can be super-imposed.</td>
</tr>
<tr>
<td>ISO/TR 16982: Ergonomics of human-system interaction - usability methods supporting human-centred design, 2002.</td>
<td>Provides information on human-centred usability methods, which can be used for design and evaluation. It details the advantages, disadvantages and other factors relevant to using each usability method. It explains the implications of the stage of the lifecycle and the individual project characteristics for the selection of usability methods and provides examples of usability methods in context. The main users of ISO/TR 16982:2002 will be project managers. It therefore addresses technical human factors and ergonomics issues only to the extent necessary to allow managers to understand their relevance and importance in the design process as a whole. The guidance in ISO/TR 16982:2002 can be tailored for specific design situations by using the lists of issues characterising the context of use of the product to be delivered. Selection of appropriate usability methods should also take account of the relevant lifecycle process. ISO/TR 16982:2002 is restricted to methods that are widely used by usability specialists and project managers.</td>
</tr>
<tr>
<td>ISO/TR 18529: Ergonomics of human-system interaction - human-centred lifecycle process</td>
<td>Defines a &quot;Usability Maturity Model&quot;, a set of practices in the design lifecycle to be human-centred and involve appropriate evaluation.</td>
</tr>
<tr>
<td>Description</td>
<td>Text</td>
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<td>-----------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>JSP 430: MOD Ship Safety Management, Part 1 Policy, May 2002</td>
<td>Defines the principal 'functional safety' policy for MOD shipping activities and has overriding precedence over other MOD maritime documents.</td>
</tr>
<tr>
<td>JSP 454: Land Systems Safety and Environmental Protection 2010.</td>
<td>Specifies the Land System Safety Board's policy and supporting guidance for safety and environmental protection and provides a framework for ensuring that both are properly addressed through life.</td>
</tr>
<tr>
<td>Acquisition Organisational Framework (AOF) guidance on HFI.</td>
<td>It is the authoritative source of policy and good practice on acquisition for MOD and our industry partners.</td>
</tr>
<tr>
<td>JSP 822: Defence Manual of Training Management, 2012.</td>
<td>Defines the MOD Individual Training and Education Governance and Management Policy. It applies to all Individual Training and Education provided to both Military and MOD Civil Service.</td>
</tr>
<tr>
<td>SSG Maritime Acquisition Publication MAP-01-010, HFI Management Guide.</td>
<td>Guidelines for the overall management of an HFI programme.</td>
</tr>
<tr>
<td>JSP 815: Defence Environment and Safety Management, 2009.</td>
<td>Describes, in high level terms, the corporate system for the management of the environment and safety throughout the MOD. Safety includes occupational health and safety and equipment and material safety. Environment includes environmental protection, sustainable development, climate change and biodiversity.</td>
</tr>
</tbody>
</table>
## APPENDIX B Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acquirer</strong></td>
<td>The stakeholder that acquires or procures a product or service forming all or part of the Solution from a Solution Provider.</td>
</tr>
<tr>
<td><strong>Acquisition</strong></td>
<td>The activities of setting and managing requirements, negotiating and letting contracts, project and technology management, support and termination or disposal based on a through life approach to acquiring military capability. These are core activities for acquisition. They take place in the context of Defence Policy Guidance, Departmental Planning, and Capability Management, and endure throughout the lifecycle in order to help deliver the Defence Vision.</td>
</tr>
<tr>
<td><strong>Capability</strong></td>
<td>The ability to generate an operational outcome or Military effect in the context of defence planning, Capability is the enduring ability to generate a desired effect.</td>
</tr>
<tr>
<td><strong>Context of Use</strong></td>
<td>Users, tasks, equipment (hardware, software and materials), and the physical and social environments in which a system is used.</td>
</tr>
<tr>
<td><strong>Derogation</strong> (Dispensation)</td>
<td>Permission or agreement to depart from the need to comply with a stated requirement.</td>
</tr>
<tr>
<td><strong>Effectiveness</strong></td>
<td>Accuracy and completeness with which Users achieve specified goals.</td>
</tr>
<tr>
<td><strong>Efficiency</strong></td>
<td>Resources expended in relation to the accuracy and completeness with which Users achieve goals.</td>
</tr>
<tr>
<td><strong>Equipment Component</strong></td>
<td>The totality of infrastructure, equipment, hardware, software, information and material necessary to deliver the required capability.</td>
</tr>
<tr>
<td><strong>Ergonomics</strong></td>
<td>A scientific and engineering discipline that is concerned with the study of human capabilities and limitations, human interactions with technologies and environments, and the application of this knowledge to products, processes and environments.</td>
</tr>
<tr>
<td><strong>Ergonomist</strong> (Human Factors Professional / Practitioner / Specialist)</td>
<td>One who practices the discipline of Ergonomics.</td>
</tr>
<tr>
<td><strong>Human Factors (HF)</strong></td>
<td>See Ergonomics.</td>
</tr>
<tr>
<td><strong>Human Factors Integration (HFI)</strong></td>
<td>A systematic process for identifying, tracking and resolving human related considerations ensuring a balanced development of both technologies and human aspects of capability. It is the process by which the Equipment Component and People Components of operational capability are made to work as a unified whole to provide the required capability, achieve specified objectives and meet defined performance criteria.</td>
</tr>
<tr>
<td><strong>Human-Centred Design = (User-Centred Design)</strong></td>
<td>An approach to design that is characterised by the active involvement of Users, a clear understanding of User and task requirements, an appropriate allocation of function between Users and technology, iterations of design solutions, and multi-disciplinary design.</td>
</tr>
<tr>
<td><strong>Operator</strong></td>
<td>The individuals and groups of people who operate, support, sustain, maintain or otherwise interface directly with the Solution. It includes MOD Service personnel, MOD Reserve personnel, MOD Territorial Force personnel and MOD Civilian employees, and may include personnel provided to MOD under Private Finance Initiative (PFI) or other service supply contracts.</td>
</tr>
<tr>
<td><strong>Organisation</strong></td>
<td>A group of people and facilities with an arrangement of responsibilities, authorities and relationships.</td>
</tr>
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<td>--------------------</td>
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</tr>
<tr>
<td><strong>People Component</strong></td>
<td>The totality of operators who form part of the system.</td>
</tr>
<tr>
<td><strong>People-Related Consideration</strong></td>
<td>A consideration (for example an issue, risk, constraint or assumption) relating to the people (users and stakeholders) and their involvement in, or interaction with, a system at any time in the lifecycle of that system. Considerations may include both positive opportunities and negative threats associated with the system development and operation.</td>
</tr>
<tr>
<td><strong>Project</strong></td>
<td>A unique set of co-ordinated activities, with definite starting and finishing points, undertaken by an individual or organisation to meet specific objectives within defined time, cost and performance parameters.</td>
</tr>
<tr>
<td><strong>Project Team (PT)</strong></td>
<td>The body responsible for developing the System Requirement Document, devising equipment solutions to meet that requirement, and managing the procurement and in-service support of the equipment. The Smart Acquisition PT is characterised by its 'cradle to grave' responsibility, its inclusion of all the skills necessary to manage its project, and its effective and empowered leader. Under Capability Management, organisations analogous to PTs may exist in other Defence Lines of Development (DLODs).</td>
</tr>
<tr>
<td><strong>Requirement</strong></td>
<td>A statement of need that is to be satisfied under the contract.</td>
</tr>
<tr>
<td><strong>Risk</strong></td>
<td>Any uncertain event whose outcome will materially affect the cost, schedule or performance of any equipment being procured within the acquisition process.</td>
</tr>
<tr>
<td><strong>Safety Case</strong></td>
<td>A structured argument supported by a body of evidence that provides a compelling, comprehensible and valid case that a system is safe for a given application in a given operating environment.</td>
</tr>
<tr>
<td><strong>Single Point of Accountability</strong></td>
<td>The Single Point of Accountability (SPA) is accountable for the co-ordination of all DLODs to support the delivery of a capability. The SPA is responsible for ensuring the delivery of the capability inherent in an investment decision across the DLODs. The SPA identifies boundaries, critical dependencies, potential trade-offs, balance of investment issues, risk mitigation and improved processes in order to develop and then oversee a pragmatic and agreed campaign plan for the delivery of new and enhanced Military Capability (MC) across all DLODs.</td>
</tr>
<tr>
<td><strong>Solution</strong></td>
<td>The totality of equipment and people that provides a required capability.</td>
</tr>
<tr>
<td><strong>Solution Provider</strong></td>
<td>An organisation or an individual that enters into an agreement with the Acquirer for the supply of a product or service. This includes design, manufacture, test, supply and provision of the means to achieve a capability, together with ongoing through-life support.</td>
</tr>
<tr>
<td><strong>Suitably Qualified and Experienced Person (SQEP)</strong></td>
<td>An individual having the necessary knowledge, training, qualifications and experience to enable them to carry out safety-related or safety-critical tasks to specified performance standards or safety.</td>
</tr>
<tr>
<td><strong>Stakeholder</strong></td>
<td>An individual, group or organisation that has a legitimate interest in the outcome of a project.</td>
</tr>
<tr>
<td><strong>Subject Matter Expert (SME)</strong></td>
<td>A person who has extensive knowledge, skill or experience in a particular field (e.g. operations, maintenance, support, HFI, Safety) and who can provide information, advice or guidance.</td>
</tr>
<tr>
<td><strong>System</strong></td>
<td>A combination of interacting elements or component parts operating together and organised to achieve one or more stated purposes or a unified set of goals. (A system may be considered as a product or the services it provides).</td>
</tr>
<tr>
<td><strong>Target Audience Description (TAD)</strong></td>
<td>A detailed description of the physiological, psychological and sociological characteristics and organisation of the types and groups of people that...</td>
</tr>
</tbody>
</table>
will operate, support, sustain and maintain the Solution together with supporting data.

<table>
<thead>
<tr>
<th>Use Case</th>
<th>A use case is a methodology used in system analysis to identify, clarify, and organize system requirements. The use case is made up of a set of possible sequences of interactions between systems and users in a particular environment and related to a particular goal. It consists of a group of elements (for example, classes and interfaces) that can be used together in a way that will have an effect larger than the sum of the separate elements combined. The use case should contain all system activities that have significance to the users. A use case can be thought of as a collection of possible scenarios related to a particular goal, indeed, the use case and goal are sometimes considered to be synonymous.</th>
</tr>
</thead>
<tbody>
<tr>
<td>User</td>
<td>People who operate, maintain and support the required capability.</td>
</tr>
<tr>
<td>User Representative</td>
<td>Person acting on behalf of the Acquirer who, in the absence of actual operators (Users), is able to identify and justify the needs and expected opinions of the operators (Users).</td>
</tr>
<tr>
<td>Validation</td>
<td>Confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled.</td>
</tr>
<tr>
<td>Verification</td>
<td>Confirmation, through the provision of objective evidence, that specific requirements have been fulfilled.</td>
</tr>
</tbody>
</table>
APPENDIX C Risk-Based HFI Activity Planning

C.1 This JSP requires MOD Staff to assess the risk to project outcomes presented by People-Related Considerations both in the specification of MOD requirements and in the proposed Solutions. This appendix presents guidance on evaluating such risks.

C.2 The concept of MOD Human Factors Integration (HFI) as a process implies a set of HFI activities, with associated inputs, outputs, dependencies and constraints. However, the nature of Defence Acquisition means that there is no single HFI process that can be successfully applied to every project. A project-specific HFI process must be devised, agreed and implemented in every case.

C.3 Within the Human Factors (HF) professional discipline, many so-called HFI activities can be identified. Well-known amongst these are activities such as: task analysis, workload analysis, allocation of functions, etc. The need for HF activities arises from the involvement of human beings in a capability and thus informs the People-Related Requirements (PRRs) of the project.

C.4 The HFI activities required for a given project cannot be pre-defined without some knowledge of how the People Component of the resulting capability will form part of that capability. Indeed it would be inappropriate to do so. If a ‘standard set’ of activities were to be carried out, unnecessary time, effort and expense might be incurred. Conversely, if a project required a HF activity to be carried out that was not part of the ‘standard set’, an inadequate or unworkable solution might result. If the need for a HF activity was to be recognised late in a project, it might be difficult, costly or even impossible to conduct that activity. Therefore, a key principle for successful HFI in any project is that HF activities should be properly planned, monitored and managed from the outset of the project, early in the Concept phase. Such a plan is known as a Human Factors Integration Plan (HFIP).

C.5 The detailed contents of an effective and efficient HFIP must be tailored to the particular needs of a project. These needs will vary depending on the nature of the project. For novel projects, involving new technologies, new ways of working, etc., extensive and detailed HF analysis and design may be required. Conversely, if a project involves the replacement of existing capability, to be used by existing Users working in an established work system, fewer HFI activities may be necessary. The guiding principle to be followed is that the scope and depth of HFI activities for a given project should be determined in relation to the project characteristics.

C.6 Experience from projects undertaken by the MOD and from a wide variety of industrial and technological sectors worldwide shows the potential risks of not addressing HFI, or doing so inadequately. Resulting increases in whole-life costs, due to inadequacies in HFI, can far exceed the front-end costs of undertaking the necessary HFI activities at the correct point in the lifecycle.

C.7 MOD staff (and Solution Providers under contract to the MOD) shall adopt a systematic and comprehensive risk-based approach towards HFI in all project situations.
Therefore the scope, extent, depth, complexity and thoroughness of all HFI activities to be undertaken, shall be determined against considerations of risk to the required project outcomes, typically measured in terms of cost, programme, capability, system performance, system safety and system usability.

Thus the requirements and guidance in this JSP are scalable to accommodate a range of project sizes, degrees of complexity and acquisition strategies.

A number of ‘types’ of risk are defined in ‘An Introduction to System Safety Management and Assurance’ [Ref 14] including business risks, insurance risks, investment risks, project risks, and safety risks.

To ensure cost-effective use of both MOD and Industry resources, and therefore to contribute to optimised project costs, the Human Factors Integration Focus (HFIF) shall ensure that the extent and depth of HFI activities that are to be carried out shall be based on an analysis of project risk (and safety risk).

<table>
<thead>
<tr>
<th>Project Dimension</th>
<th>Risk Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Size (≈ Monetary Value)</td>
<td>Large projects present greater overall management challenges. Many organisations, including many individuals, may be involved in delivering the solution.</td>
</tr>
<tr>
<td></td>
<td>The risks in such a context are that HF activities will be overlooked, under-resourced, treated inconsistently, or uncoordinated. A coordinated set of HFIPs is an essential tool to mitigate such risks.</td>
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<tr>
<td></td>
<td>In small projects, the risk is that HFI activities are seen as unnecessary, or as unaffordable against a small overall budget.</td>
</tr>
<tr>
<td></td>
<td>Experience shows that People-Related issues and risks are usually unrelated to project size and their contribution to overall project risk needs to be assessed on their own merits.</td>
</tr>
<tr>
<td>Diversity of Requirements</td>
<td>Where Stakeholders present a diverse range of requirements and expectations, it is likely that PRRs will be difficult to achieve. To mitigate this risk, greater up-front analysis of People-Related (Human Factors) issues will be necessary.</td>
</tr>
<tr>
<td>Maturity of Requirements</td>
<td>Where requirements for the Equipment Component of a capability are not well matured, it will be difficult to arrive at a valid set of PRRs. This risk can be mitigated by ensuring that candidate PRRs are fully documented and analysed and that the PRR set is regularly reviewed and updated. An Early Human Factors Assessment (EHFA) is likely to identify problem areas, and also suggest possible or optimal directions.</td>
</tr>
<tr>
<td>Technological Novelty</td>
<td>Where a capability involves new technologies, there is a risk that People-Related aspects will not easily be identified. Technology designs may exist ‘on-paper’ long before a solution is realised. It is only when the realisation is defined and built that People-Related issue become obvious. The problems of addressing People-Related issues in the later stages of such a project are often insurmountable. Problems may include unacceptable project delay, large cost overruns, inefficient solutions, ineffective solutions, and unsupportable solutions.</td>
</tr>
<tr>
<td>Project Dimension</td>
<td>Risk Considerations</td>
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<tr>
<td></td>
<td>Any apparent high costs associated with HF activities in the early stages of such a project will be miniscule in relation to the potential procurement and ownership costs if necessary activities are not carried out.</td>
</tr>
<tr>
<td>Conceptual Novelty</td>
<td>Where capability acquisition involves new concepts, there is a risk that People-Related issues will be inadequately managed. New concepts often originate from new technologies that are more tangible and thus easier to develop conceptually.</td>
</tr>
<tr>
<td></td>
<td>The risk is that the role of human beings, in relation to technology, and how new technologies, will impact upon existing people-systems, (including manpower, training, logistics support, information systems) will be overlooked or inadequately considered. A common problem is that the role of people is considered too late in the project lifecycle, when technology decisions cannot be changed, leaving the people component to ‘pick up the pieces’.</td>
</tr>
<tr>
<td>Technological Complexity</td>
<td>A capability may involve complex technology solutions. Technological complexity, often involving computer-based solutions, is a proven source of project risk. Complex systems often bring complex HF considerations that require significant effort to identify, capture and manage.</td>
</tr>
<tr>
<td>Organisational Complexity</td>
<td>A capability may involve well-established technology solutions, but may use these in novel ways. New types of User or new User groups may be involved. Novel ways of working may be required. If large numbers of Users or large numbers of User groups or military organisations are involved, People-Related issues may dominate, and People-Related risks may be high.</td>
</tr>
<tr>
<td></td>
<td>If a purely technological approach is taken, such a project may be seen as low risk. Adequate EHFA will be justified in order to identify, analyse and quantify people-related risks, and so determine the extent of HF activities to be undertaken.</td>
</tr>
<tr>
<td>Operator Population</td>
<td>Where the expected Operator Population is less than fully defined, it will be difficult to identify and agree a complete set of PRRs.</td>
</tr>
<tr>
<td>Procurement Strategy</td>
<td>For procurement contracts based on a Prime Solution Provider managing other sub-contracts, management of HFI in the Design phase will be relatively low risk, since responsibility for coordination of Solution Provider HFI Activities can be assigned to the Prime Contractor.</td>
</tr>
<tr>
<td></td>
<td>Where a capability is acquired through a number of separate contracts between the Acquirer and various Solution Providers, the risk to successful HFI will be greater, and will fall to the MOD to manage (unless delegated to a third party).</td>
</tr>
<tr>
<td></td>
<td>Where a capability is provided to the Acquirer by Industry, such as in the form of a service contract or Private Finance Initiative (PFI) contract, the scope for inadequacies in HFI escalate.</td>
</tr>
</tbody>
</table>

Table 2 Types of Project Related Risks and Potential Mitigations
APPENDIX D  HFI Activities

Rationale for Performing HFI Activities

D.1 At each stage of a capability project and a solution lifecycle, certain Human Factors Integration (HFI) activities need to be carried out to enable the project to progress satisfactorily. Moreover, certain HFI activities can only be carried out when the project has reached a certain stage of development. Thus the timing and duration of HFI activities must be carefully synchronised with other project activities primarily to ensure the necessary information flow between Stakeholders and between the Acquirer and the Solution Provider.

D.2 In practice, Defence Capability Solutions may be realised using a range of system lifecycle models. Typically these are selected by Solution Provider organisations to support their particular organisation needs, and to suit industry custom and practice, technology type, procurement style, etc\(^\text{10}\). Therefore, HFI Plans (HFIP) need to be recognised with such differing lifecycle models and must align HFI activities with the chosen model.

D.3 As illustrated in Figure 3, the guidance in this document is based on a generic system lifecycle model that represents a broad, high-level systems engineering process which suits a wide range of MOD Capability Acquisition projects. This generic system encompasses the following systems engineering lifecycle stages:

a) Identified Capability;
b) Concept Definition;
c) Initial Gate;
d) Preliminary Design;
e) Main Gate;
f) Detailed Design;
g) Production, Integration, Testing and Acceptance;
h) In-Service period;
i) Mid-Life Capability Upgrade(s) (MLU);
j) Disposal (Decommissioning).

D.4 For projects that use the CADMID\(^\text{11}\) lifecycle model, these stages can be readily aligned with the established phases of the CADMID cycle (Figure 3 and Figure 11).

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\(^{10}\) Software-intensive projects for instance may use the so-called 'waterfall' lifecycle model. The 'waterfall' model is a sequential design process in which progress is seen as flowing steadily downwards (like a waterfall) through the phases of Conception, Initiation, Analysis, Design, Construction, Testing, Production/Implementation and Maintenance.

\(^{11}\) Concept, Assessment, Demonstration, Manufacture, In-Service, Disposal.
D.5 In addition, Figure 11 presents how the lifecycle stages can be aligned with established MOD Systems Readiness Level (SRL) and Support Solutions Envelope (SSE) milestones. The MOD’s SRLs have been developed as a project management tool to capture evidence, and assess and communicate System Maturity in a consistent manner to stakeholders. SRLs define a set of nine maturity steps from the Concept phase to the In-Service phase, across a set of systems engineering disciplines, including Human Factors (HF). Each of the SRL steps align with key outputs from systems disciplines. SRLs are intended to be ‘descriptive’ and not ‘absolute’ as work on each system discipline may progress at a different rate.

Figure 11 HFI Activities aligned with System Readiness Levels (SRL) and HFI Maturity Levels\textsuperscript{12}

\textsuperscript{12} For detailed solution development.
HFI Maturity Assessment

D.6 This section provides guidance on assessing the maturity of HFI aspects of projects at various stages, equating to a series of nine SRLs as shown in Figure 11. The guidance embraces both HFI activities undertaken by the Solution Provider in accordance with an agreed HFIP and those activities that are required to be undertaken by the MOD in accordance with this JSP. The guidance given here is consistent with similar guidance on assessing overall project maturity using SRLs.

HFI Maturity Levels Appraisal Framework

D.7 The appraisal framework presented is an established tool that has been used successfully to assess a range of MOD acquisition projects. At each SRL, a single high-level “assertion” is posed. The single high-level assertion is amplified in a number of lower level questions.

D.8 The nine high level SRL "assertions" relating to nine levels of "HFI Maturity" that should to be assessed throughout a Capability project and a solution lifecycle, together with their accompanying rationale, are presented in Table 3. Each assertion is accompanied by guidance on typical HF issues and HFI activity outputs.

D.9 The schema is available as a standalone Excel based self assessment for use by Project Teams (PTs) and MOD assessors. The extant version is available from the DES TECH-EG HFI-Pol and the Acquisition Organisational Framework (AOF).

Table 3 HFI Maturity Levels Appraisal Framework with Abbreviated Rationale

<table>
<thead>
<tr>
<th>SRL</th>
<th>Assertion</th>
<th>Rationale of HFI Maturity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The HF issues implicit within the User Requirements Document (URD) have been understood.</td>
<td>At this stage of a project’s maturity, HFI must begin with an analysis of human aspects related to the acquisition of the proposed capability, and an assessment of the associated risks and requirements. The HFI objective during this level is to ensure that the stage outputs submitted at Initial Gate take account of any human-related aspects, which could seriously affect the ability to meet the projects’ objectives. This applies to all outputs including; Requirements (URD), draft System Requirements Document (SRD) and Invitation to Tender (ITT) Statement of Requirements (SoR), plans (costed) plan for Assessment, Through Life Management Plan (TLMP) and contribution to other specialist plans such as Safety and Integrated Logistic Support (ILS) and cost effectiveness assessment (impact of human performance and human costs).</td>
</tr>
<tr>
<td>2</td>
<td>The human role in the system has been clearly defined.</td>
<td>At this level, more detailed work is undertaken to understand, quantify and begin to reduce the HFI risks identified during the earlier phase. This will involve exploring major issues, such as manpower reduction, job design, workload, performance shortfalls and safety management.</td>
</tr>
<tr>
<td>3</td>
<td>The People-Related</td>
<td>At this stage of a project’s maturity, a comprehensive</td>
</tr>
<tr>
<td>SRL</td>
<td>Assertion</td>
<td>Rationale of HFI Maturity</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>4</td>
<td>HF have been considered within the SRD and responsibilities for HF have been aligned with other disciplines.</td>
<td>At this stage of a project’s maturity, a comprehensive HF understanding of the capability has been used to develop system requirements that are aligned with other project disciplines.</td>
</tr>
<tr>
<td>5</td>
<td>Initial evaluation of HF has been conducted and tested.</td>
<td>At this stage of a project’s maturity, specifications are refined to ensure robust HFI content, with clear human performance targets. Contractor offerings are evaluated to predict operability, etc of the eventual solutions. HFI considerations must be included in the down-selection criteria for equipment characteristics, associated services, overall integration and the process offered to develop and deliver the solution and reduce risks. After down selection, contractor HFI effort becomes more closely coupled to MOD activities like training and support analysis. MOD provides user expertise to support the contractor’s HFI team.</td>
</tr>
<tr>
<td>6</td>
<td>Sub-systems in representative integration environment have been verified.</td>
<td>At this stage of a project’s maturity, key sub-systems are integrated with realistic supporting elements so that sub-systems can be tested in a simulated operational (lab) environment.</td>
</tr>
<tr>
<td>7</td>
<td>The system prototype has been demonstrated in a representative integration environment.</td>
<td>At this stage of a project’s maturity, a representative prototype system should be demonstrated (with all major sub-systems integrated and operating) in a high fidelity simulated environment such as a vehicle integration test rig.</td>
</tr>
<tr>
<td>8</td>
<td>The project has achieved acceptance of the human related aspects of design and function.</td>
<td>At this stage of a project’s maturity, the final system prototype should be demonstrated in a representative target platform.</td>
</tr>
<tr>
<td>9</td>
<td>The project must be capable of monitoring and managing any future issues related to HF in completing the TLMP.</td>
<td>At this stage of a project’s maturity, declaration of In-Service Date (ISD) follows demonstration of effective integration of the equipment with the human component (personnel, procedures, support and training regimes) under operational conditions. While in-service, HFI evaluation helps to identify any human related performance shortfalls or failures of human-equipment integration. Where capability increments are proposed the HFI process repeats in microcosm of the earlier phases.</td>
</tr>
</tbody>
</table>
Guidance on Performing HFI Activities

D.10 The following sections provide an overview of typical HFI activities, as represented by the green horizontal bars in Figure 11, which should be performed throughout a Capability project and a solution lifecycle. For each activity, the text identifies the goal or goals, the rationale for carrying out the activity, and the success criteria that are to be applied. The HFI activities are:

a) Establish HFI Baseline;
b) Analyse Organisation Characteristics;
c) Develop TAD\(^\text{13}\);
d) Conduct Comparability Analysis;
e) Conduct Preliminary HAZID and HAZAN\(^\text{14}\);
f) Develop HFICR\(^\text{15}\);
g) Develop People-Related Requirements, Assumptions and Constraints;
h) Provide HFI Input to the URD;
i) Provide HFI Input to the SRD;
j) Support Selection of a Solution Provider;
k) Secure SQEP HFI Resources;
l) Conduct HF Technical Activities in Accordance with the HFIP;
m) Develop and Implement an ITEAP\(^\text{16}\);
n) Mitigate and Close-out of HFI Considerations;
o) Provide HF Input to Safety Case Development;
p) Provide HFI to Project Products;
q) HFIWG\(^\text{17}\);
r) HFI Aspects of Project and System Interfaces.

\(^{13}\) Target Audience Description
\(^{14}\) Hazard Analysis
\(^{15}\) HFI Considerations Register
\(^{16}\) Integrated Test, Evaluation and Acceptance Plan
\(^{17}\) HFI Working Group
Establish HFI Baseline

**Goal:** To collate the information necessary to form a baseline description of the key HFI-related considerations that will be assessed during an Early Human Factors Assessment (EHFA).

**Rationale:** The HFI Baseline is a collation of relevant documentation that describes the nature of the project, its objectives, initial assumptions and constraints. The HFI Baseline is that sub-set of the project information that particularly relates to the People Component. Within the HFI Baseline, there will be information that introduces, describes and plans for an EHFA. It outlines the HF activities to be carried out under the EHFA. For each HF activity to be undertaken as part of the EHFA, the HFI Baseline outlines the overall methodology, objectives, plans and resources required. The HFI Baseline will draw on a wide range of documentary sources, reports and people in order to compile a sound platform for the EHFA.

**Success Criteria:** A baseline description of the HF issues and risks, which informs the EHFA.

Analyse Organisation Characteristics

**Goal:** To identify the impact of the acquisition on the user organisation.

**Rationale:** Knowledge of HF relating to PRRs is needed as it enables optimised performance and safety, and reduces costs throughout the project lifecycle. The characteristics of the user organisation are matched against the Capability requirements to identify the following:

- a) Manpower Requirements;
- b) Existing Job and Roles;
- c) Training Requirements.

**Success Criteria:** An understanding of the impact of the Capability requirements on the user organisation is established.
Develop TAD

**Goal:** To understand the characteristics of the user and the user organisation in order to provide a basis for Solution design and HFI activities therein. The typical vehicle for communicating this information in MOD Capability acquisition projects is the TAD.

**Rationale:** A TAD is the structured description of the physical, psychological and social and organisational characteristics, together with capabilities and limitations of the people who will operate, maintain and support the Capability. The TAD will enable Project Team Leaders (PTL), Human Factors Integration Focus (HFIF), Stakeholders, Subject Matter Experts (SMEs) and Solution Providers to ensure project decisions are properly informed by adequate information and knowledge of human-related risks. Data sources for the TAD include:

a) Anthropometric tables;
b) Manning Studies;
c) Training Needs Analysis (TNA);
d) System Design;
e) Habitability Assessments;
f) Health and Safety Analysis.

**Success Criteria:** An understanding of personnel capabilities and limitations and the potential implications for the platform, equipment and complement.

Conduct Comparability Analysis

**Goal:** To compare existing capabilities or solutions with the proposed solution.

**Rationale:** Analysis of existing in-service, predecessor or analogous equipment with similar characteristics to the proposed solution may reveal HF considerations that must be addressed during the project. The comparability analysis should be undertaken in conjunction with the EHFA.

**Success Criteria:** An understanding of HF-related considerations within existing capabilities that may impact on the proposed solution.
Conduct Preliminary HAZID and HAZAN

**Goal:** To identify HF-related hazards within the proposed solution and subject them to initial assessment.

**Rationale:** A preliminary HAZID and HAZAN systematically identifies potential top-level safety hazards in order to quantify and manage them through risk assessment. This will be undertaken in support of the Safety Case. A further stage of initial hazard analysis is required based on a HF assessment – a Human HAZID. The Human HAZID will focus on potential hazards generated by operators (human error, rule violation etc). Hazards generated by the Solution (unless caused by human error for example) will usually be managed by the team developing the Safety Case. All hazards, including those identified by Human HAZID, are recorded in the project hazard log and managed by nominated members of the project team.

**Success Criteria:** Potential HF-related hazards have been identified and recorded in the project hazard Log.

Develop HFICR

**Goal:** Provide an efficient and effective management tool to keep track of considerations, identify mitigation measures and record any actions performed to close out the considerations.

**Rationale:** Risks, issues, constraints, assumptions etc associated with human and system performance should be co-ordinated and managed within a HFICR. This should be used to define and track key Human-Related considerations as the system develops, and ultimately all considerations should be considered and resolved before the system is accepted into service.

The main purpose is to outline the likely impact of each issue, prioritise them and propose a strategy for resolution. The HFICR should be kept live throughout the project. As the project progresses, the main source of considerations to be managed will shift progressively from exploratory work, research and experience with other systems, to assessment studies on the new system and feedback from the evolving experience with the system itself. There are high potential gains relating to cost, performance and safety if human considerations are identified and managed throughout the process.

Key People-Related risks identified within the HFICR will be transferred to the overall Project Risk Register in accordance with the Risk Management Strategy adopted by the Project.

**Success Criteria:** The identification, management and mitigation or close out of all project-related people-related risks.
Develop People-Related Requirements, Assumptions and Constraints

**Goals:** Develop testable PRRs that will support the solution design.

Develop requirements that take account of human capability and allow the operators to perform tasks safely, reliably and effectively in a safe working environment.

**Rationale:** PRRs are requirements that relate to the needs, interfaces, constraints and performance of the people that form part of systems delivering a capability. Constraints and assumptions are either generic or derived from capability analyses. PRRs relate particularly to those aspects of the ‘equipment’ parts of the system that affect the people, and to those aspects of the people that affect the ‘equipment’.

PRRs are organised into three categories:

a) Overarching PRRs - because people are part of the system;

b) Service-Specific PRRs - because a particular set of people will use the system;

c) Capability Configuration-Specific PRRs - because of the particular needs arising from the capability.

In addition, certain HFI process requirements must also be specified. See [Ref 1] part 1 for further information.

PRRs are input into the URD and SRD. To align with the nature of the URD, PRRs are captured in a Single Statement of User Need (see below). The single statement links to more detailed PRR statements in the SRD and other project documentation.

The process of capturing PRRs must begin early in the project programme. A complete set of PRRs will not be captured in one initial swoop; PRRs will emerge and evolve throughout the Concept phase. PRRs will go through a process of refinement and tradeoffs with stakeholders.

Nevertheless, the PRRs development process must meet project timescales and deliverables. PRRs must therefore be mature before an ITT is issued, and so must be included in Contract Documentation.

**Success Criteria:** A systematic framework of testable PRRs for managing requirements during acquisition.
Provide HFI Input to the URD

**Goal:** To ensure that HFI is satisfactorily achieved in a timely and cost-effective manner.

**Rationale:** The nature of MOD URD precludes the inclusion of PRRs Statements which, of necessity, address many detailed issues.

Top-level HFI requirements are captured in a Single Statement of User Need of the form:

"The Capability shall cost-effectively, and sustainably employ people, including those responsible for <list of functions>, provide them with a <living and> working environment that promotes their safe, effective functioning, in all intended theatres of operation, and under all intended operational conditions, in compliance with the constraints imposed by the structure, operational practices, ethos and principles of the <organisation>"

This requirement is absolute and is not tradable.

**Success Criteria:** A Single Statement of User Need agreed and included in the project URD.  

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18 This overall statement of User Need is taken from Def Stan 00-250 and provides a top level requirement for inclusion in the URD from which all lower level People Related Requirements (e.g. in the SRD and Statement of Solution) can be derived.
Provide HFI Input to the SRD

**Goal:** Provide a definitive list of PRRs and associated acceptance criteria for inclusion in the SRD.

**Rationale:** Knowledge of HF is needed to make decisions about which components of the operational capability (equipment or human) will perform different functions. Human-Related risks can also be reduced through HF input to the SRD, as part of the HFI process, which specifies the whole system, including the human components.

System level requirements capture is a translation of user requirements into system requirements. The structure of the SRD responds to the statements within the URD. It is important that the HF user requirements are integrated into the SRD. The previous decisions regarding allocation of function will act as a baseline for defining equipment and human boundaries within the SRD. Contributions to the SRD will be obtained from the candidate requirements developed from the earlier development of high-level PRRs.

The SRD PRRs can be encapsulated in four high-level requirement statements:

a) Employ the right people for the job;
b) Provide a suitable working (and where appropriate, living) environment;
c) Support work and non-work HF;
d) Satisfy User Organisation constraints.

Based on the top-level PRRs and their associated constraints and assumptions, more detailed requirements can be derived. These requirements are based on the eight Defence Line of Development (DLOD) categories:

a) Training;
b) Equipment;
c) Personnel;
d) Information;
e) Doctrine and Concepts;
f) Organisation;
g) Infrastructure;
h) Logistics.

In addition, Interoperability is identified as a key system characteristic that must be achieved. HF input into a SRD provides a concise list of HF related system requirements and associated acceptance criteria, which is an important step as it enables the project to move forward towards Main Gate. See APPENDIX G for further guidance on PRRs.

**Success Criteria:** Requirements that capture performance, safety and cost factors relevant to the human element of the solution. Maximise the re-use of published PRRs in Def Stan 00-250, Service-Specific PRR sets and proven legacy project feedback.
Support Selection of a Solution Provider

**Goal:** To assist in the selection of a Solution Provider.

**Rationale:** Providing HFI input and support to the selection of a Solution Provider is an important step in contract placement. Whilst the HFI approach may not be the decisive factor in selecting a solution provider, the purpose of HFI input to the process is to identify and manage any risks that emerge from a particular Tenderer’s approach to managing HFI within a contract. Possible outcomes from HFI input to the process, prior to contract placement may include:

1. A Tenderer may be required to modify their proposed approach to HFI within the contract before the contract is placed (often the best solution);
2. A need for additional HFI resources (and additional contracts) may be identified. This may create additional project interfaces;
3. Stakeholders may be alerted to potential HFI risks and so make more informed decisions;
4. A contingency may be included in the project budget against future HFI risks.

Supporting the selection of solutions is achieved by establishing specific success criteria and applying these to the tender submission in order to produce a “score sheet” against which the tender is assessed. The scale of support will be dependent upon the type and size of the project. Also, support may be required after contract award (working with sub-suppliers, selection of Commercial Off-The-Shelf (COTS) solutions etc) and will therefore be subject to the level of project maturity or other factors. Of principal concern is the provider’s approach to HFI risk management as described in the Tenderer’s HFIP or outlined in the tender submission. Where an HFIP was not required as part of the tender submission, it is important that the provider has supplied sufficient evidence to demonstrate a clear understanding of the HF elements of the project and is able to mobilize suitably qualified resources in sufficient quantities to deliver the work.

**Success Criteria:** A tender submission that has demonstrated an understanding of the PRRs and where appropriate has supplied a HFIP that meets the needs of the project.

Identified shortfalls in a Tenderer’s approach are identified and mitigated.
Secure SQEP HFI Resources

**Goal:** To ensure that SQEP will implement the activities defined in the HFIP.

**Rationale:** Solution providers are required to carry out many HFI activities. Activities will be executed through a HFIP. In order to execute the plan SQEP will be required.

A SQEP should have the relevant competence to execute the work. Depending upon the nature of the activities, the solution provider may need to be a professional ergonomist, HF engineer or psychologist (HF specialist), or a person with considerable experience of undertaking HFI in a Defence context. Additionally, the customer may directly employ SQEPs to support the work programme and liaise with or manage the solution provider or its suppliers.

**Success Criteria:** The appointment and deployment of SQEPs to execute the HFIP.

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**Conduct HF Technical Activities in Accordance with the HFIP**

**Goal:** The purpose of the activity is to develop a design solution that meets the PRRs.

**Rationale:** The activities to develop a design solution that meets the PRRs will depend upon the specific HF technical requirements. Typically within each technical area there will be a process of analysis, specification, review and revision. Successful solution development for PRRs should form part of the iterative process of: Analysis, Specification, Review and Revision.

**Success Criteria:** Typical activities which may be needed to implement the HFIP are outlined in Table 4 below.

<table>
<thead>
<tr>
<th>HFI Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocation of Function</td>
<td>A process of allocating tasks to humans and machines with a view to matching each component’s strengths with tasks. Allocation of Functions is often iterative and relies upon experience and expert judgement.</td>
</tr>
<tr>
<td>Environmental Design</td>
<td>The design of the environment in which users perform tasks (or inhabit) may be critical to user performance and well-being. Whilst the physical aspects of environmental design will lie outside the HF domain, skilled HF input to the design process is vital.</td>
</tr>
<tr>
<td>Human Factors Style Guides</td>
<td>Documents detailing user-equipment interface components with the aim to provide a consistent and standardised format guide.</td>
</tr>
<tr>
<td>Human Reliability Analysis</td>
<td>The identification of the likelihood of human error in complex systems and the impact of such errors in order to form the basis for system re-design and error reduction methods.</td>
</tr>
<tr>
<td>Job Design</td>
<td>The combination of tasks and roles to form a job that can be</td>
</tr>
<tr>
<td>HFI Activity</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Maintenance aspects of the solution must be considered within the HFI process.</td>
</tr>
<tr>
<td>Simulations, Mock-Ups and User Trials</td>
<td>In order to reduce project risk, proposed solutions to People-Related Requirements may need to be tested and tried using user representatives under realistic conditions. Field testing may be impractical in the early stages of solution development. HFI best practice utilises a range of techniques to achieve user testing. Many of these involve low-cost approaches such as mock-ups. Controlled user trials may be difficult and expensive to achieve. Increasingly computer-aided simulations are used.</td>
</tr>
<tr>
<td>System Safety</td>
<td>Overall management of system safety will usually be managed by non-HF specialists. However, HF input to the analysis of hazards, risks and mitigations is essential. This is particularly so where a safety case relies upon claims for human actions. Particular data, methods and approaches may need to be used. Specialist SQEP input is likely to be required and justified. Nuclear safety cases require particular approaches and processes to be followed.</td>
</tr>
<tr>
<td>Target Audience Description</td>
<td>A TAD is the usual medium for disseminating a description of the skill, knowledge, physical, psychological and physiological characteristics, capabilities and capacities of the intended user population.</td>
</tr>
<tr>
<td>Task/Link Analysis</td>
<td>Many HF activities need to be based on a form of task analysis, the purpose of which is to understand what people must do to deliver the capability and will or are likely to do in using the system. Task/Link Analyses are processes that identify task components and interactions. Analysis can be used to inform design layout and provide a basis for manpower and user performance modelling. Task analysis may need to be developed into analyses of individual and group workloads.</td>
</tr>
<tr>
<td>Training</td>
<td>The capture of training requirements and the definition of the training solution forms part of the HFI process. This may be undertaken by SMEs from the training community. Activities include, training needs analysis, training gap analysis, training solution selection and delivery.</td>
</tr>
<tr>
<td>User Characteristics</td>
<td>The Solution must take account of and provide for user characteristics and those of the user organisation. Again, all PRRs must be analysed in the contexts that the capability will be delivered.</td>
</tr>
<tr>
<td>User-Equipment Interface Design</td>
<td>The process used to define Human-Machine Interfaces (HMI) and Human Computer Interfaces (HCI) for equipment. This process ensures the information and controls necessary to perform user tasks and equipment are designed appropriately.</td>
</tr>
<tr>
<td>User Modelling (Anthropometric)</td>
<td>The representation of user physical involvement and movement characteristics within a simulated working environment in order to enable the iterative design of workstations and workspaces.</td>
</tr>
<tr>
<td>User Needs Analysis</td>
<td>HF aspects of the Solution must be based on an analysis of user needs. Many of these will be human-related and so covered by publicly available HF data and guidance. Some user needs will be military related, requiring reference to military data and guidance such as that in Def Stan 00-250. Other user needs may arise from</td>
</tr>
<tr>
<td>HFI Activity</td>
<td>Description</td>
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<td>---------------------------</td>
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</tr>
<tr>
<td>User Performance Data</td>
<td>In order to meet overall system performance requirements, the performance of the People Component must be considered. This may require the use of User Performance Data. Once again, PRRs must be analysed in the contexts that the capability will be delivered. Whilst publicly available Human Performance Data may be relevant, it is more likely that the Solution will require military-specific User Performance Data to be used. This may require data collection to be undertaken.</td>
</tr>
<tr>
<td>Workload Analysis</td>
<td>Workload levels are analysed to identify achievable workload levels in order to inform decisions about the allocation of functions, user roles, number of personnel and the design of the user-equipment interface.</td>
</tr>
<tr>
<td>Workspace/Workstation Design</td>
<td>The design and layout of a workspace/workstation so that it is compatible with the tasks undertaken and the physical characteristics of the users.</td>
</tr>
</tbody>
</table>

Table 4 Typical HFI Activities

**Develop and Implement an ITEAP**

**Goals:** Ensure that the Project’s ITEAP supports the valid, evaluation and formal acceptance of solutions to PRRs.

Ensure that all HFI-related activities described in the ITEAP are carried out.

**Rationale:** Hitherto, PRRs were often not expressed in terms that allowed formal acceptance. This led to PRRs being omitted from ITEAPs. Recent developments in HFI guidance now allow (and require) formal communication of HF requirements, in the form of PRRs, each with defined acceptance criteria.

Aspects of the capability that relate to integration between human and equipment components require HF input into the ITEAP. HF evaluation must cover operability, maintainability, supportability, and trainability. Developing an ITEAP will involve activities which aim to test that the intended users will be able to use the system in an operational environment and actually achieve required standards of task performance as intended.

Carrying out an ITEAP may involve Factory Acceptance Tests, Site Acceptance Tests and Operability Trials.

**Success Criteria:** The development and implementation of a plan demonstrating that requirements have been met within a given scenario.
Mitigate and Close-out of HFI Considerations

**Goal:** To resolve or mitigate HFI Considerations.

**Rationale:** HFI considerations must be closed out in order to ensure that the solution delivered to the Customer is not compromised by unresolved HFI risks. The elimination or mitigation of HFI considerations is undertaken throughout the project via technical activities (design, risk assessment etc.) and organisationally through meetings with the HFIWG or project-level organisations, such as the project safety committee/working group, to discuss and resolve issues. Typically this may involve addressing and resolving the following components:

- **a)** Customer / Supplier Agreements (CSAs);
- **b)** Outputs from the ITEAP;
- **c)** Risks identified during EHFA and other issues recorded in the HFI Considerations Register.

A final review during project acceptance should be undertaken to ensure that risks have been reduced to As Low As Reasonably Practicable (ALARP) or have been eliminated.

**Success Criteria:** A design solution has been reached where HFI Considerations have been addressed and either resolved or mitigated.
Provide HF Input to Safety Case Development

**Goal:** To ensure that HF arguments for equipment HMI and operators are incorporated into the safety case.

**Rationale:** A Safety Case is a structured argument, supported by a body of evidence, which provides a valid case, that a system is safe for a given application in a given environment. The Safety Case should clearly describe the arguments and evidence used to justify the safety of the system, and demonstrate that the processes and assessments made are sufficient, so that agreement can be reached on the validity of any safety claims. Project HF activities make an important contribution to the Safety Case.

HF safety claims are not the exclusive properties of the equipment or the operator elements but are emergent properties of the system. They can only be addressed through assurance of the interaction of operators and equipment. A three-part sub-division of the system allows HF to be integrated at the appropriate level – equipment, interface and operators. The interface element refers to all the activities where the equipment and operators interact to produce the system capability. This represents an argument for functional safety – that the interaction of the system components is safe under the specified operating conditions (see Figure 12).

A comprehensive safety case ensures that the necessary measures to control known hazards and limit the risks have been accounted for and implemented throughout the solution’s lifecycle. The Safety Case should mature along with the project. Continuity and improvements to safety and risk management systems increase safety performance, reducing the likelihood of errors and the associated subsequent costs. A more detailed explanation can be found in [Ref 1] and [Ref 5].

**Success Criteria:** A comprehensive safety case would provide the following evidence:

- **a)** Equipment has been constructed to meet the requirements for safe commissioning, operation, maintenance and disposal (supported by HFI activities);
- **b)** The HMI permits the operators to perform safety-critical and other tasks reliably in a safe working environment (led by HFI activities);
- **c)** The operators are capable, competent and available in sufficient numbers to perform their operational roles in the system safely (supported by HFI activities).
Provide HFI to Project Products

**Goal:** To contribute HFI knowledge and input to linked Project products.

**Rationale:** A number of Project documents and supporting analyses will require input from HF specialists and SMEs in order for them to be considered complete. Such documents and analyses include:

- a) Development of the Concept of Operations (CONOPS);
- b) Development of the Concept of Employment (CONEMP);
- c) Assumptions, Issues, Safety and Project Risk registers;
- d) SRDs;
- e) URDs;
- f) TLMP;
- g) Hazard Log;
- h) Safety Case and Safety Management System;
- i) ITEAP
- j) Combined Operational Effectiveness and Investment Appraisal (COEIA).

**Success Criteria:** All significant HFI considerations are addressed in Project documentation to the extent and depth required. HFI is an integrated part of Project processes and products.
Guidance on Performing HFI Management Activities

HFIWG

Goal: To oversee the HFI programme.

Rationale: The HFIWG consists of MOD Stakeholders, MOD SMEs, and Solution Provider HF staff. The HFIWG is responsible for the management or execution of the HFI programme. The HFIWG is established at the earliest possible stage of the project and continues its work until the Customer accepts the Solutions. The HFIWG should meet at regular intervals, the frequency of which shall be matched to the tempo of the project and the scale and significance of HFI activities. HFIWG membership will reflect the HFI activities that are in hand and the project stage. For more information on HFIWG see APPENDIX K.

Success Criteria: The successful execution of the project HFIP and the management of the HFICR, achieved through regular monitoring, reporting and timely introduction of corrective actions to mitigate emerging risks. The HFIWG will be key to ensuring all PRRs are met.

HFI Aspects of Project and System Interfaces

Goal: To ensure that HFI is managed across project and system boundaries.

Rationale: Responsibility for solution requirements may extend across system boundaries. This is particularly true of human considerations. For example a PT sub-group may have ownership of equipment sensors and their location but the characteristics of the associated visual alerts or auditory annunciations may be the responsibility of the HF engineers. Therefore it is vital that control of requirements and their acceptance/qualification is managed. At the project level there are major boundaries such as ship-aircraft interfaces or multi-vehicle interactions that must be managed. Interfaces fall into three categories:

a) External Interfaces: control over boundaries between the system and external components that interact with the system;
b) Requirements within a system, which cross project boundaries;
c) Commercial Interface: control over boundaries between different suppliers.

Success Criteria: An effective configuration control and requirements management system that facilitates the management of HF across project and system interfaces.
APPENDIX E System of Systems Approach

What is System of Systems Approach (SOSA)?

E.1 SOSA is the UK MOD’s response to drive improved coherence, interoperability and reuse at the System of Systems (SoS) level.

E.2 Modern agile capabilities are delivered as a collection of systems that need to work together – a System of Systems.

E.3 A SoS is a set or arrangement of systems that results when independent systems are integrated into larger systems that deliver unique capabilities.

E.4 MOD Acquisition and Capability management has traditionally operated at a systems level and as such each system’s time, cost and performance envelope is maximised against the atomised requirements placed against that system with little consideration of the systems that MOD already owns or will be operated with. This independent approach to system planning, development and delivery leads to systems that fail to interoperate appropriately together, fail to exploit reusable components, are not appropriately agile, have differently designed Human Machine Interfaces (HMIs) and have different manning patterns, etc. This is in turn leads to capability that has no safety pedigree, is delivered late, is over budget and does not reach its full operational potential.

E.5 These emergent business, operational and technical risks at the system of systems level are owned by MOD and often result in expensive rework and fix programmes, procedural work-arounds and additional workload (physical, cognitive and capability shortfall) carried by the front-line service men and women.

Three Components of SOSA

E.6 SOSA is about enabling the MOD with the support of industry to deliver the capability required through commonality, reuse and the interoperability of independently procured systems. SOSA consists of three core components:

SOSA Principles

E.7 A set of 9 principles published in JSP 906 [Ref 9] and the MOD Enterprise Architecture Strategy that guide the required behaviours and culture within MOD and Industry to deliver a coherent and interoperable system of systems. The principles also empower the Operating Model.

   a) Unifying the Defence Enterprise;
   b) Driving business and operational effectiveness;
   c) Minimising diversity;

19 Note the term interoperability is being used in a very wide and general sense. It concerns the correct and optimised coexistence of systems across all lines of development and is significantly more than just electrical and physical interfaces.

20 Agility includes technical, commercial and system as well as operational.
d) Designing for reuse;

e) Building with proven solutions;

f) Ensuring commonality of services across the Defence Enterprise;

g) Designing for flexible interoperability;

h) Adopting open standards;

i) Information as an asset.

**SOSA Target Operating Model (Blueprint)**

**E.8** SOSA Blueprint is: A defined target “end state” of the SOSA operating model which is required to achieve the stated vision and principles. It can also be defined as the SOSA “Target Operating Model”.

**SOSA Body of Knowledge (BoK)**

**E.9** This is a single repository that enables MOD and industry to access SOSA information. The BoK contains the principles, operating model, systems engineering lifecycle processes and domain artefacts together with introductory and training material to coach MOD to deliver SOSA.

More information can be found on the MOD’s Acquisition Operating Framework (AOF):

http://www.aof.dii.r.mil.uk/aofcontent/tactical/sosa/index.htm
Pre-Contract Placement Activities

Establish HFI Baseline
- Establish Concept & Objectives
- Produce HFI Strategy
- Produce HFIP
- Establish Context of Use
- Identify Operational Modes & Scenarios
- Analyse Legacy System Data & Feedback
- Define User Population & Characteristics
- Develop Project-Specific TAD

EHFA
- Conduct EHFA
- Identify & Document People-Related Considerations
- Create HFICR
- Assess & Manage People-Related Project Risks

People-Related Requirements
- Identify & Document People-Related Assumptions & Constraints
- Identify & Document PRRs & Compliance Measures & Priorities
- Conduct Trade-Offs
- Incorporate PRRs into Contract Specifications

Contract Placement Activities

Support Solution Provider Selection Process
- Assess Tenderer’s HFIP
- Assess Proposed HF Methods & Tools
- Assess Tenderer’s HFI Compliance Statements
- Assess Consequent People-Related Project Risks
In-Contract Activities

Iterative Solution Development

- HFI Activity Planning
- Solution Acceptance
- HFI Activity Management
- People-Related Requirements & Considerations
- Concept of Use Information
- Population Characteristics
- Solution Design & Realisation
- HF Design Audits
- HF Analyses
- Inputs to Project Documentation

Post-Contract Activities

- Maintain HFI Documentation
- Evaluate Project HFI Outcomes
- Feedback Lessons Identified to Future Projects

In-Service Activities

- Revisit EHFA
- Establish HFI Baseline
- Capture PRRs from In-Service Feedback
- Produce HFIP for Mid-Life Capability Upgrade

Disposal Activities

- Hazards to People
- Hazards Created by People
- Input to Disposal Safety Case
APPENDIX G  People-Related Requirements

G.1 Complex technological systems have relied heavily on the use of formal requirements statements, together with associated compliance and acceptance methods and criteria. Thus for the engineering component of a system, the Acquirer can be assured that all their specified requirements have been met by the solution to an agreed extent. In contrast, attempts to formally specify Human Factors Integration (HFI) requirements have proved more problematic and thus HFI has often been less than optimal\textsuperscript{21}.

G.2 Since the people are an essential system component, ignoring or inadequately considering them is not acceptable as this may increase acquisition and lifetime costs, and may result in reduced capability.

G.3 System requirements specify what the system will be like, what it will do, and how well it will do it. Sub-system requirements do the same, and in addition specify interfaces between sub-systems, and the constraints they impose on each other in terms of performance, service demands, etc.

G.4 People-Related Requirements (PRRs) describe a set of requirements relating to the needs, interfaces, constraints and performance of people that form part of systems delivering a capability. It is necessary to systematically identify, capture, analyse and manage PRRs to avoid negative outcomes.

Benefit of PRRs

G.5 PRRs derive from the employment of people as part of a system or systems that deliver a capability. They relate particularly to those aspects of the ‘equipment’ parts of the system that affect the people, and to those aspects of the people that affect the ‘equipment’. In this context, the term ‘equipment’ is used in this document to refer to all tangible non-human parts of the solution that deliver a capability, including hardware and software, platform, systems and fittings, deployable components and non-deployable components (infrastructure).

G.6 PRRs provide an effective means of coupling people issues into the systematic framework for managing requirements during acquisition, which traditionally has been biased towards an equipment-centred view of capability. The inclusion of PRRs in User Requirements Documents (URDs), System Requirements Documents (SRDs) and acquisition specifications makes requirements relating to people explicit, particularly during the critical earlier phases of acquisition.

\textsuperscript{21} Historically, HFI ‘requirements’ have been incorrectly labelled as ‘non-functional’, implying that all such requirements are qualitative descriptors of more tangible elements. Also, there is a popular misunderstanding of the scope of ‘HF’. Whilst the Human Factors (HF) professional will understand the term to embrace all aspects associated with people in technological systems, many individuals who are involved with Defence Acquisition have developed the notion that HFI concerns only the Human Machine Interface (HMI) or soft issues to do with human preferences. The root causes of many projects shortfalls can be traced to such misconceptions.
Capturing PRRs

G.7 For a URD, a single succinct requirement that links to a separately documented set of PRRs is all that is required.

G.8 For an SRD, PRRs can be encapsulated in four high-level requirements statements that are applicable to all defence systems:

a) Employ the right people for the job;

b) Provide a suitable working (and where appropriate, living) environment;

c) Support work and non-work human functions;

d) Satisfy User Organisation constraints.

G.9 All other, more detailed PRRs can be derived from these. In addition, MOD acquisition practice requires Solution Providers to comply with certain HFI process requirements (see Def Stan 00-250 Part 1). PRRs shall be organised under three major headings, as shown in Table 5.

Table 5 PRR Set Types

<table>
<thead>
<tr>
<th>PRR Set Type</th>
<th>Content</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overarching PRRs</strong></td>
<td>System requirements that arise because human beings are part of a military system.</td>
<td>The need to provide adequate space and environmental working conditions for people.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The need to design visual displays in accordance with human performance capabilities and limitations.</td>
</tr>
<tr>
<td><strong>Service-Specific PRRs</strong></td>
<td>System requirements that arise because a particular group of military personnel are part of the system (e.g. Army, Navy or Air Force).</td>
<td>The need to provide self-contained accommodation spaces on a ship or submarine.</td>
</tr>
<tr>
<td>(Note that detailed PRRs have been developed for Naval Capability acquisition projects).</td>
<td></td>
<td>The need to conform to current Air Force organisational hierarchies in the manning solution.</td>
</tr>
<tr>
<td><strong>Capability Configuration-Specific PRRs</strong></td>
<td>System requirements that arise because the particular group of military personnel must achieve certain functions as part of the system</td>
<td>The need for equipment Users to locate and identify targets or achieve a specified rate of fire.</td>
</tr>
</tbody>
</table>

G.10 PRRs (or tailored versions of them) must live alongside more traditional requirements expressed in ‘hard engineering’ language, so it is important for them to be expressed, as far as possible, in compatible language. That is possible, but only up to a point, because there are some important differences between the ‘people’ and ‘equipment’ components of a system.
Characteristics of People

G.11 Although PRRs are 'real' requirements that must be used alongside more conventional 'engineering' requirements, they cannot be made to look identical to equipment-related requirements, because people themselves are different from engineered components, as illustrated previously in this section. The differences of most importance to the use of requirements in acquisition (and in particular acquisition of Defence Capability) are:

a) People are the ultimate Off-The-Shelf system component, which sets them apart from most engineered system components. Their design, and therefore their basic performance, cannot be changed, nor can the fact that some design attributes (e.g. stature, gender mix) may change measurably over the life of a capability and cannot be controlled. Some aspects of higher-level performance can be modified by training, but only within limits, and it is usually costly to do so;

b) The 'quality' of people is variable. Selection can remove extremes, but at the cost of numbers, and from a shrinking part of society (those prepared to consider a military career). Solution quality can vary over the lifetime of a platform, in response to societal pressures and trends. There is no alternative Solution Provider with a better model, or even a development programme to produce one;

c) For some functions, the use of people is mandatory. Functions like hostile engagement, navigation and lookout, all require a human decision-maker;

d) For many functions, there is no economic alternative. Functions like humanitarian relief or search and rescue could not be provided without people;

e) The characteristics of people are in many ways more complex than those of engineered components, and so is their behaviour. This complicates system modelling and design, and in some cases can render exhaustive analysis impractical;

f) Human behaviour, especially in decision-making tasks, is not entirely deterministic. The ability to apply initiative, common sense and lateral thinking are, of course, human strengths, but they complicate both performance testing and the prediction of functional failure and recovery modes;

People are sentient. They are aware of what they do, as well as doing it. Even within a highly disciplined context, their performance, motivation and morale are affected by emergent properties of the tasks and jobs that they do. Job coherence affects performance directly, because it affects the positive or negative feedback of experience into knowledge, skill, and hence future performance. Affective properties of tasks and jobs (stimulation, challenge, satisfaction, boredom, drudgery, etc.)
drive motivation, concentration, and hence long-term performance. They also influence retention;

g) People ‘have a life’. When they go off watch, their lives continue with recreation and other non-work activities, which contribute to their overall well-being and hence to their ability to perform as part of the capability. In fact, in many jobs, they will not even ‘switch off work’, but will discuss work-related issues with colleagues, and their subconscious minds will turn over work-related problems ‘on the back burner’. In the context of a naval platform, the design of work facilities and living facilities may be correlated;

h) People have complex physical needs. Sustaining the human in good physical and psychological condition is far more complex than providing power supply and waste heat extraction for a machine, with periodic filter cleaning and lubricant changes. When people live within the system, as they do in almost all naval situations, these complex support needs must be built into the solution;

i) People have social needs. They need to relate to other people in ways that they find agreeable. Different people have different social needs that must be met. In addition, there are collective social needs to be met if people are to bond together as a unit, and function effectively as parts of inter-dependent teams;

j) People exist within an organisational context. For instance the Royal Navy, Army or Air Force are not just a collection of individuals with various skills. People fit within coherent groups, as part of a hierarchical structure. Most things that people do, whether on or off task, are affected by these relationships.

G.12 So, when acquiring a system containing a mandatory, non-modifiable sub-system or component, the engineered components must be designed around this particular Off-The-Shelf element, in order to work effectively with it.

G.13 PRRs are intended to capture this complexity of human needs and capabilities, in ways that shape and constrain the solution to meet them, but do not unduly constrain the solution in ways that would inhibit innovation. To use the PRRs successfully, it is essential to understand the ways in which people are different from equipment, and to help bridge the gap between their world and the ‘hard’ world of the technology that must support them, and with which they must integrate in order to deliver the capability. This will entail a progressive transformation from the language of the high level PRRs to the language of solution specifications at lower level, while managing and testing trade-offs between competing requirements, and competing solution constraints.

Summary

G.14 Ultimately, the aim is for solutions with testable properties that trace back to the PRRs. However, the nature of PRRs means that different approaches to requirements acceptance may be needed. Not every PRR can be subject to
hard engineering testing. Some degree of subjective judgement, and consensus based on supporting evidence, must also be admitted.
APPENDIX H   HFI Plan – Minimum Contents

H.1 The Human Factors Integration Plan (HFIP) should address, as a minimum, the following topics:

a) Brief summary of the contracted work;
b) Full details of objectives, scope, purpose and structure of the HFIP;
c) Details of all persons and post-holders who are responsible for managing Human Factors (HF); People-Related issues and Defence Lines of Development (DLOD) representatives;
d) Details of all Human Factors Integration (HFI) activities;
e) Details of the proposed methods to identify and manage:
   i) People-Related assumptions;
   ii) People-Related constraints;
   iii) People-Related issues;
   iv) People-Related dependencies;
   v) People-Related risks;
f) Details of the proposed methods to identify and engage stakeholders;
g) Details of the proposed methods to identify and engage users and user representatives;
h) Details of the proposed arrangements to manage People-Related trade-offs;
i) Details of HF analytical methods, tools, and techniques that will be used;
j) Proposals for the use of prototyping in design, verification and acceptance;
k) Proposals for trials, especially those involving MOD personnel;
l) Proposals to achieve design iteration (as specified in ISO 9241-210);
m) Proposals for managing Commercial Off-the-Shelf (COTS) solution related issues acceptance;
n) People-Related activity milestones;
o) People-Related activity outputs and deliverables;
p) Inter-relationships with other project activities;
q) Inter-relationships with other project documents (including TLMP\textsuperscript{22}, ITEAP\textsuperscript{23}, TNA\textsuperscript{24}, Project Risk Register, Project Safety Case).

\textsuperscript{22} TLMP – Through Life Management Plan
H.2 The HFIP may contain additional topics considered necessary to properly scope and manage project HFI activities. The HFIP should be updated when significant changes to any of the topics listed above occur throughout the Solution design and realisation process.
APPENDIX I MOD Architectural Framework – Human Views

MODAF

I.1 The MOD Architectural Framework (MODAF) offers a way to describe current or future enterprises from different perspectives or viewpoints, e.g. strategic and operational, to support the planning and management of military Capability change. Human Views (HVs) have been developed to capture the People Component in a MODAF consistent format, providing an opportunity for embedding people factors at the earliest opportunity within Capability Planning. HVs play an important role in the specification and management of requirements. As a programme progresses to Capability Delivery, HVs can also be used to inform subsequent Human Factors Integration (HFI) activities e.g. development of People-Related Requirements (PPRs) in the User Requirements Document (URD) and System Requirements Document (SRD). The components of the HVs, and their inter-relationships are illustrated in Figure 13.

![Figure 13 MODAF Human Views and their Inter-relationships](image)

I.2 More detailed guidance on using the HVs is provided in a stand-alone document published by the Human Factors Integration Defence Technology Centre (HFI DTC) entitled The Human View Handbook [Ref 15]. The information captured in the ‘human views’ may be represented as separate views or integrated within existing MODAF views e.g. System Views. It is important that the People-Related aspects of the System are captured and represented appropriately to support the design and development process, as part of good Systems Engineering practice.

I.3 For up-to-date information on these developments, the reader should contact the Engineering Group (EG) within Defence Equipment and Support (DE&S).
APPENDIX J  Solution Acceptance

Solution Acceptance Issues

J.1 The Human Factors Integration Focus (HFIF) is required to ensure that all People-Related and Human Factors (HF) aspects of the Solution are adequate and suitable for acceptance by the relevant MOD Authority.

J.2 This is a crucial step, since it crosses a contractual boundary. The issue is accepting that the solution spelt out in the contractor's specification, supported by the tests and trials offered to provide evidence, will provide the evidence the People-Related Requirements (PRRs) require.

J.3 For PRRs that relate to human performance, the aim is to ensure that suitable tests are included along with equipment performance tests. For any PRRs that have not been so transformed, and refer to intangibles, the equipment specification alone is not adequate, i.e. the solution cannot be bought as a black box. There must be an accompanying contractual requirement for how the contractor will engage with stakeholders, and what types of evidence must be produced, to support stakeholder acceptance that the (non-testable) PRRs are met by the solution.

J.4 The evidence may take the form of practical results from trials under realistic conditions of use, etc., or documented evidence of stakeholder consensus. It goes without saying that such PRRs must be worded in a way that a (competent) contractor understands what is required, and can engage with stakeholders, and conduct appropriate exploration (during Assessment or Demonstration Phase) of their implications. If, as is normal, the 'solution' is to be provided by several Solution Providers (equipment, manpower, training, support), then it is the totality of the aggregated solutions, and the interfaces between them, that must meet the requirements of the specification.

J.5 Acceptance of the delivered equipment component is against the contracted (equipment) specification, which will contain testable criteria, already accepted to represent the requirements in the System Requirements Document (SRD). If there were any intangible PRRs, then the Project Team (PT) will seek consensus among the relevant Stakeholders that the supporting evidence presented in accordance with the contract has demonstrated compliance. A wise contractor will of course be keen to gain this consensus as early as possible during the contract period, and will plan activities accordingly.

Evidence for Acceptance

J.6 All requirements need evidence that they have been met on which to base acceptance. In many cases, the evidence might just be the result of a test at or before the time of acceptance. This applies to measurable equipment attributes (like size, power output, etc.) and to many aspects of performance (both equipment and human). Some attributes (even some quantitative ones) cannot be easily measured before acceptance (e.g. equipment reliability or structural durability). Here there are well accepted methods for
generating evidence based on a combination of historical performance of similar components (if available), accelerated wear and failure tests, predictive statistical modelling, and so on. In these cases, the evidence is accepted as a proxy for the currently un-measurable attribute.

J.7 Some PRRs require a similar, evidence-based, approach to acceptance, either because the desired attribute cannot be directly measured, or because it cannot be assessed reliably until long after acceptance. Evidence-based acceptance requires the production of timely, appropriate evidence. Those involved must understand the significance of the requirement, the type of evidence needed, and how it can best be generated. In traditional areas like equipment reliability or structural corrosion, this knowledge is readily available to the contractors involved. Acquirers too, generally understand what is needed, and so can act as ‘intelligent customers’. In the case of PRRs, this understanding is not always so readily available. Appropriate application of the good Human Factors Integration (HFI) practice referenced in this guide by both PT and contractor should help.

J.8 Evidence-based acceptance of requirements (at all stages, (see previous section)) is important for PRRs, since a high proportion of those in the reference set (i.e. in their generic, non-tailored form) have the means of compliance stated as CE (Consensus based on Evidence). The adequacy of the evidence depends partly on its content (the results) and partly on acceptor’s confidence in the process that created it. The PRRs do not include requirements for what the PT, contractor or other Solution Provider should do, but process does play an important role in generating credible evidence. Practices such as (early and substantive) involvement of stakeholders and process visibility are particularly important for building confidence to support PRR acceptance.

J.9 The scope of the PRRs is quite diverse, and the range of contexts that will apply to different projects adds more diversity. Projects should be prepared to use whatever evidence can be provided at reasonable cost, which genuinely supports acceptance of requirements and design decisions. That may include any or all of:

a) Comparability studies with similar solutions that take into account any differences in the context of use;

b) Analysis directed towards the currently proposed requirement or solution, including task analysis, job analysis, manning analysis, workload analysis, communication analysis, error analysis, etc;

c) Predictive modelling in any of the above areas;

d) Evaluation and experimental results from mock-ups, prototypes, etc;

e) Surveys of attitudes, satisfaction, etc., of relevant groups;

f) Data on current and predicted attributes of people (physical, cognitive, social, etc).
Quality of Evidence

J.10 How well the evidence supports acceptance depends on the quality of the evidence provided. The quality depends primarily on:

   a) Relevance (does it really apply to the required attribute, or to something loosely related?) to the conditions of use and the actual User;
   b) Robustness (is it reliable, and not prone to errors, omissions or spurious influences?);
   c) Confidence (why should the stakeholders believe it?).

J.11 For PRRs, relevance includes particular attention to the context of use, since changed context of use is a major threat to integration of people in a system. Robustness depends on many things - if the evidence involves experimental results, then allowance for human variability, and the degree to which participants represent the Target Audience, are important factors. Confidence is strongly influenced by the extent to which stakeholders have been engaged with the project.

Who Provides the Evidence?

J.12 The evidence must be assembled and presented by whoever is seeking acceptance. The evidence may be created in several ways:

   a) The accepter (the person or organisation seeking acceptance) may create it (e.g. by conducting trials using prototypes, or by in-house analysis);
   b) The accepter may commission someone else to create it (e.g. specialist analysis, modelling or research);
   c) The accepter may encourage others to provide it (e.g. through collaborative data sharing between projects, or by alignment of objectives in related research programmes);
   d) It may already exist (e.g. any results of related prior work whose context is close enough to the project’s).

J.13 In all cases, the accepter must select suitable evidence, possibly from one or more source, and assemble it into a coherent case to support acceptance.

J.14 Some evidence needed to support PRRs will fall into the first two categories because it relates to things that are novel in the project, or because the results would not be valid if obtained from a third-party source. But for many PRRs, some of the supporting evidence could be obtained from third-party sources. This is much more likely to be achieved if the project plans early for how to gain PRR acceptance.

J.15 The Integrated Test, Evaluation and Acceptance Plan (ITEAP) should contain a section on PRRs that identifies the scope of evidence needed and have a strategy for how it can most economically be obtained in the required timescales.
Staged Provision of Evidence

J.16 Modern acceptance practice is based on early assurance that the solution will be correct, rather than late testing to find out whether it is correct. This principle is particularly relevant to PRRs where acceptance is based on consensus, since early provision of evidence helps to build stakeholder confidence in the evolving solution. Even if the evidence highlights the need for change, the fact that the issues can be rectified builds more confidence than them remaining unknown. Where a contractor is involved, this confidence-building is a significant risk reduction activity. Even where acceptance of a PRR is ultimately reliant on a human performance test, early evidence gives all parties confidence that the test will be passed, so there will be ‘no surprises’ at contract acceptance.
APPENDIX K  HFI Working Group Model Terms of Reference

Purpose

a) The Human Factors Integration Working Group (HFIWG) shall provide a forum for the identification of any and all people-related (Human Factors (HF)) issues that may influence the outcome of the Project.

b) The HFIWG shall provide a means for effective communication, co-ordination and consensus formation among the stakeholders in the Human Factors Integration (HFI) process, by providing a forum for the interchange of ideas and information.

c) The HFIWG shall help to achieve trade-offs and resolve conflicts between different HF technical requirements.

Membership

a) The membership of the HFIWG shall be determined at the outset of the Project, and shall be reviewed regularly by the Project Team Leader (PTL) or their nominee. The group membership shall be adjusted to reflect the detailed HFI activities that are in hand as the project progresses.

Working Arrangements

a) The HFIWG shall be convened at the earliest possible stage in the project and shall continue its work until the Customer accepts the Solutions.

b) The HFIWG shall meet at regular intervals, the frequency of which shall be matched to the tempo of the project and the rate and significance of HFI activities.

Chairmanship

a) The Human Factors Integration Focus (HFIF) shall convene and chair the HFIWG, take the lead and overall responsibility for the working group and ensure accurate minutes are produced and actions arising are dealt with in a timely manner, preferably within two weeks of the meeting.

b) The HFIF shall arrange for proper attendees from the MOD and other Stakeholders as required by the agreed-upon agendas.

c) The HFIF shall ensure that the effort to support the working group is fully resourced by the Stakeholder community in a timely manner.

Responsibilities

The HFIWG shall:
a) Oversee the management of all people-related issues that are identified by its members, or brought to its attention by others.

b) Oversee the processes by which people-related requirements are identified, captured and managed. These processes may be carried out by sub-groups of the HFIWG.

c) Oversee all aspects of the HFI process including the development of all Solution Provider (Prime and Sub-Contractor) HFI Plans, and any HF related system design and development (including issues related to operation, maintenance and support) and through-life planning (e.g. software upgrades) activities.

d) Bring to the attention of other Stakeholders, all people-related matters that are judged likely to affect the successful outcome of the Project.

e) Bring to the attention of other Stakeholders, any significant issues (where the HFIWG has not reached a consensus) for consideration.

f) Make recommendations (where the HFIWG has reached a consensus) that may result in any system engineering design or contractual changes to PTL for consideration.

g) Identify and review, through the HFI Considerations Register (HFICR), any HF related risks and ensure they are recorded in the Project risk register.

h) Report to the PTL and to Stakeholders at agreed intervals the status and detailed content of the HFICR.

i) Define and recommend to the PTL for endorsement, the HF criteria that need to be satisfied in order that the Acquirer can accept the Solution.

j) Consider the requirements for system acceptance in the Personnel HFI Domain Line of Development and pass recommendations to the PTL for consideration.

k) Consider the requirements for system acceptance on the Manpower HFI Domain and pass recommendations to the PTL for consideration.

l) Consider the requirements for system acceptance on the Human Engineering HFI Domain and pass recommendations to the PTL for consideration.

m) Consider the requirements for system acceptance on the Organisational and Social HFI Domain and pass recommendations to the PTL for consideration.

n) Arrange for the provision of safety and HF related data and assumptions necessary for the design and realization of the Project Solution to MOD Subject Matter Experts (SMEs) and to Solution Providers.
o) Maintain a record of recommendations and issues raised or agreements reached.

p) Produce, disseminate and promulgate any outputs from the work of the HFIWG.

q) Take due note of the activities and status of the HFI Process, schedule, progress and deliverables and manage accordingly.

~ End of Document ~